IV. Leaving the question untouched as to the propriety of making the palace of the legislature a sort of museum and gallery of art, we may reasonably hope that when they come to be in the very atmosphere of art, the members of the Two Houses will be in some degree infected by it. How much—that is, how little they now understand or care for art is tolerably evident from the truly unfortunate *nem. con.* that sanctioned the adoption of such a design for the new façade of Buckingham Palace as the one "presented" to them by Royal Command. Not a single voice was raised to protest against the architectural iniquity of inflicting upon us such a piece of commonplace and even vulgar design—the subject considered—for the front of a royal palace at the present day; and after all the revilings, too, that have been heaped upon the original building, as concocted by George the Fourth and John Nash. To sneer at their taste now would be akin to questioning the sublime taste of Queen Victoria and Edward Blore, and be compromising our loyalty. Nevertheless, I do wish that Ben D'Israeli's excellent advice were taken, and that an architect were hanged *in terrorem* to the rest of the tribe. And if such wholesome example is to be made at all, let it not be on some paltry Pecksniff, the architect, perhaps, of a gin-palace, but on some higher offender—even the architect of a royal palace.

V. Extolling the elaborate richness of the Palace of Westminster, one critic has very naïvely expressed his astonishment at Mr. Barry's herculean task in having to design such a prodigious quantity of details, there being hardly a square foot of plain surface in the building, either externally or internally. The manual labour and workmanship are of course prodigious, but the number of drawings required is comparatively very moderate, those for one bay or compartment of the structure serving almost for an entire side of it; inasmuch as a single portion of the kind once designed becomes the pattern for as many others as are to be made similar to it. Or does the sapient critic imagine that an architect makes working drawings for every individual column, window, and other part that are repeated again and again without variation? If so, he must be first cousin to the Irishman who went to a tailor to order two suits, and having being measured, stood waiting the renewal of that operation, exclaiming, "I told you that I wanted two suits, and you have taken the measure for *one* only."

VI. Some who, if not more talented, are cleverer than Mr. Barry—that is, show greater cleverness in sparing themselves trouble—make very short work indeed of designing details, taking them ready-made, and applying them on every occasion alike. One architect, who shall be nameless—for proper names are sometimes highly improper things—has had for his whole stock of ideas, in the course of a long practice that must have been a profitable though hardly can it be called a successful one,—just a couple of patteras for columns, and the same number for windows, which he has served up again and again, with an abstinence of invention and imagination truly marvellous. Let us hope, however, that the day is approaching when it will be exacted of architects that they shall exhibit *bonâ-fide* design in their compositions, and also that their compositions shall be legitimately entitled to such name, by being framed according to artistic principles, instead of being, as is now generally the case, mere crude hap-hazard compilations, in which, though every one of the separate features may be good in itself, being taken from here and there, they do not well assort together, or else are not so suitable as they ought to be to the express occasion. Detail ought to proceed invariably from the architect's own pencil; or if he be incapable of producing it, and be so far a mere mechanic, by what right, or rather with what specious show of right, does he usurp the style of ARTIST?—rendering himself thereby a mere quack. Or if, as seems to be the case, we really do not care for having Artist-architects, let us have the honesty to declare so at once, let us desist from vapouring about the excellence of architecture as a Fine Art, and let us fling ourselves into the arms of those two doxies—Camdenism with its vinegar-visaged orthodoxy, and Pecksniffism with its drunken, gin-palace heterodoxy.

VII. The following, from Donaldson's Maxims, can not be too earnestly recommended to a great many, both in and out of the profession:—"He who expects to be a good architect by knowing the history of all the styles, and the phases which it (architecture) has assumed through each period, will find himself much mistaken when he begins to practise. He may be a good historian, and a judicious critic, but not necessarily a good artist."—Certainly not, for, on the contrary, he may be a very bad one—that is, no artist at all. Even with regard to criticism, too, mere historical knowledge without æsthetic feeling and intelligence will go but a very small way, and produce nothing better than one of those very small critics who, profound in dates and authorities, are exceedingly shallow indeed when it comes to questions of real, unprejudiced criticism; and, to give them their due, they seem to have the grace to know it, for most studiously do they avoid approaching any question of the kind. We have one learned Professor who goes about surveying cathedrals very much in the spirit of an appraiser, and with just as much eye for their peculiar artistic beauties. For my part, I never take up an account of a building without most devoutly wishing that it had no history at all, and that there was nothing else to be spoken of but the structure itself, which is now generally converted into a mere peg to hang a tissue of musty gossip and anecdotes upon. *Et tu Brute!* I apostrophized Jovellanos the other day, on turning over his "Carta Historico-Artistica sobre el Edificio de la Lonja de Mallorca,"—for it is as dull as if it had been written by Dr. Dryasdust or Professor ———. The *Artistica* is certainly quite superfluous—nay, worse, positively deceitful, and most maliciously so, exciting as it does the most agreeable expectations only to disappoint them. "*Heureux les peuples,*" says Voltaire, "*dont l'histoire est ennuyeuse;*" and if so, architecture ought to be in a most enviably happy condition indeed, since nothing can be duller than its history as it is usually served up to us.

VIII. Of detestable heresies in matters of Art, the most detestable of all is that which would persuade us that Art can be taught by rules, and ought to subserve to rules. It is the most detestable because the most grovelling and abject,—the most alien from the very spirit of Art. Rules are for dull-witted pedants and schoolboys; the artist, if he really be one, has got beyond them, and abandons himself to those inspirations. Inspirations!—if I smile, I also groan while I write that word in reference to architecture. Inspirations! where do we find them in our *Art?* Nor, may we hope to find them so long as a merit is made of the most barefaced copyism, and of the most servile regard to Precedent. Now, if *Architecture* really be not a Fine Art, let it be exposed as a mere pretender and impostor, and let us hear no more of it. For my own part, I would much rather pronounce its doom at once, and say with the stern Roman patriot, "*I, lictor, colliga manus.*"

IX. While there is a great deal of verbose gabbling and prosing about styles, scarcely anything at all is ever said or written upon the subject of what belongs or ought to be made to belong equally to all styles, it being a *sine qua non* in Architecture properly so called in contra distinction from Building,—namely, Æsthetic or Artistic effect. Yet it seems to be the very last thing of all that is either thought of or studied. The effect that comes by chance—because it is, perhaps, just that which the forms employed must of necessity produce under any circumstances—is but of a feeble, ordinary kind, whereas the higher quality of Artistic effect never comes by mere good luck. If it is to be at all, it must be provided by the architect himself; nor can he possibly provide it without understanding it, studying it, and aiming at it. He must study it, too, in regard to composition, adjustment of masses, play of both *plan-line* and outline, and relief and chiaro-scuro, as well as in regard to subordinate parts and details; which latter are now generally made all in all, although they are seldom more than borrowed; and, indeed, such borrowing is now made a positive merit, and is accepted if not exactly as evidence of talent, as an all-sufficient substitute for it. In Fine Art of whatever kind, effect is every thing, and all the rest no more than the means of producing it. Would, therefore, that architects would begin to attend to it much more than they have hitherto done, and then we should have something very much better than the correct dulness they now so frequently present us with. And if they want a study for effect, they may find one in the north-west corner of the Bank of England, which, if they have any eye or feeling whatever for effect, ought to inspire them. Nevertheless, most strange to say, there is not one who has since caught an idea from that exquisite little architectural gem—Soane's best and truest monument. The Institute ought to have a well-executed model of it, both as a most valuable study, a truly admirable precedent, and as a compliment to their benefactor. Nay, without any particular affection towards the man, I should rejoice to see a statue of Soane himself placed within that classical loggia, where its *effect* would be almost enchanting.

X. All-incredible as it is, it is nevertheless fact—a dismal and a damning one—that at the late meeting of the Archæological Association at Norwich, not one of the egregious architectural cognoscenti there assembled thought it worth while to pay a visit to Cossey Hall, although it is in the immediate neighbourhood of that city, and is in many respects a *chef d'œuvre* specimen of Ancient English Domestic architecture of the palatial class. It is true it is but a modern production, still it is a charming artistic imitation, strongly reminiscent of Thornbury, and other excellent examples of the same period. Very ill indeed does it become archæologists to turn

their backs upon, or turn up their noses at, modern works of that description, when they themselves are all the while labouring with might and main to bring modern-antiquity into general vogue among us. Such people have a most strange way of showing their gratitude, and an equally strange way of showing their taste. As to the latter, both that and their admiration of what they do condescend to admire, appear to be regulated entirely by dates and registers. Such learned owls see best in obscurity and darkness. The broad daylight of the actual truth quite dazzles and scares them.—If it be strange that the archæologists should have treated Cossey as they did, it is hardly less so that none of our architectural draftsmen, who sometimes seem very much at a loss for fresh and interesting subjects, should have exercised their pencil upon that mansion, which is certainly not deficient in varied and highly piquant parts. But the shadows of archæology are fast falling upon and darkening the whole land of Art,—enwrapping it in its own morbid gloom, till Dulness, universal Dulness, reign. Then take my advice in time: Fling physic to the dogs and Precedent to the devil.

HISTORY OF ARCHITECTURE IN GREAT BRITAIN.

A Brief Sketch or Epitome of the Rise and Progress of Architecture in Great Britain. By James Elmes.

"Epitomes are helpful to the memory, and of good private use."
Sir Henry Wotton.

(Continued from page 271.)

The four great epochs of architecture in England are, as hath been shown,—I. The introduction of the art into Britain by the Romans, until its decadence by the Saxons.—II. The introduction of the Ecclesiastical or Pointed styles by the Normans, through all the rich exuberance of the florid Plantagenet and Tudor styles, to the mixed anomalies of the Holbein, Elizabethan, or picturesque styles, which fell into desuetude shortly after the death of Elizabeth.—III. The revival of the Roman and introduction of the Italian styles by the Stuarts, to the absence of all style and schools which marked the reigns of our first two princes of the house of Hanover.—IV. The patronage of all the polite arts which distinguished the accession of George III., and the establishment of the Royal Academy, to the present day; in which period all the styles have been revived and practised, with various degrees of success, and to which we owe the introduction of the pure simplicity and unrivalled elegance of the Greek style, as well as the eccentric architecture of the Chinese and the ponderous eternities of the Egyptian. This latter epoch, so abundant in materials both in theory and practice, will form the subject of the following section.

The overflowing exuberance of our English language, which soars above the pure simplicity of a mother tongue, borrows its words, phrases, and idioms from the Hebrew, Latin, Saxon, Norman, German, French, Dutch, and even from the Arabic and other Eastern tongues, at pleasure; engrafts such as are suitable for its purpose, rejects the useless or those which are merely pedantic, and thus renders it the most powerful and rich of modern languages. So have the architects of the Georgian-Victoria period, by a similar usufruct of every known style of their art, rendered the architecture of our time more exuberant and usefully elegant than any other single people. They have not used the Greek style to monotony, the Italian to littleness, the Gothic to florid pedantry and heraldic exaggeration, nor any to satiety; but, with a few solitary exceptions, have engrafted a freedom of style and an unfettered selection from the beauties of every clime to their productions. Hence, although we have no style of architecture that can be properly called English, we have a rich engrafting upon our parent wild stock, domestic utility, a mixed but not incongruous style, rich and exuberant as is our language. Therefore, the architecture of England, if it cannot be called English architecture, is like the Venus of Praxiteles, composed of the choicest elements of beauty.

In the early part of the reign of George the Third, Sir William Chambers enjoyed the royal favour and almost the whole of the architectural employment of the day. Fond of ease, he indulged in his professional reveries in his office at the Board of Works. Not being a regularly bred architect, or even builder, he educated no pupils—that is to say, as the word is now understood: he therefore formed no school, and left little more than his Somerset-house, his Royal Exchange, Dublin, a few edifices of lesser notoriety, his Chinese buildings at Kew, and his "Treatise on Civil Architecture," to perpetuate his fame; but his name will always hold a distinguished place in the list of British architects. His only followers or pupils were bred in the office of the Board of Works, in which he held the situation of surveyor-general. Among the principal of these were his friend and associate, John Yenn, for whom he obtained from his royal master the diploma of R.A. and the honourable office of treasurer to the Royal Academy; William Gandon, who distinguished himself by his able editing of the last two volumes of the "Vitruvius Brittannicus," his splendid buildings of the Custom house, the four Courts, and Parliament house, Dublin, and some private edifices in other parts of Ireland; the late Mr. Hardwick, father of the present eminent architect of that name; and the late Mr. John Buonarotti Papworth, who received sufficient directions for his professional studies and advice in the selection of models, to warrant a small claim to that title. This gentleman's father and elder brother were the eminent plasterers to the Board of Works, and as they executed the beautiful ornamental plastering and stucco work to the cornices, ceilings, coves, and panels of Somerset-house, some of which in the Royal Academy form frames for decorations from the pencils of Reynolds, Cipriani, Regaud, Mary Lloyd, and other members of that institution, the young Buonarotti, who exhibited early in life a decided love and taste for ornamental design, had often easy access to the architect and to the building.

Of the first of these, namely John Yenn, notwithstanding the honourable addition of R.A. to his name, his only known work is that part of the Treasury which faces St. James's Park, and grins horribly upon Holland's pretty edifice of Melbourne-house, and Kent's picturesque composition of the Horse Guards: and this is his only voucher to the honourable title of Royal Academician, in the newly-established Royal Academy of Painting, Sculpture, and *Architecture!* This extraordinary event the architect commemorated by presenting his brother academicians with a geometrical elevation of his design, shaded with Indian-ink and tinted with gamboge, in the manner of the day, and framed and glazed, with his autograph (John Yenn, R.A., Architect). Of his right to this title Dr. Johnson bears witness in his Dictionary, wherein he says that "Architect" is a noun substantive, and means a contriver of anything;—*ergo*, John Yenn is an architect, for he contrived the north front of the Treasury. His original (?) design for that contrivance is still in the collection of works presented by the Royal Academicians to the Academy, and is preserved, though rather in an obscure corner, in the council-room of that institution, honoured by a companionship with the self-selected works of Reynolds, West, Lawrence, Hoppner, Wyatt, Dance, and other eminent cotemporaries; his successors being purposely omitted from the comparison.

The first symptom of a regular-bred genuine architect in the reign of George III. was James Wyatt. Being the son of an eminent and opulent builder in the city of London, who was much concerned in government and other large building contracts, he received the elements of a sound scientific education necessary either for the builder or the architect. After being thus far qualified in his father's establishment, he refined and purified his taste by investigating the finest ancient and modern structures, and in visiting the best schools of architecture in France and Italy. Foreign travel in those days was absolutely necessary for one who aspired to the eminent profession of an architect; for, with the exception of Sir William Chambers's little Goshen in Scotland-yard, there was no school or master of the art, properly so called, in England. It is true, that at the commencement of the Royal Academy, Thomas Sandby, brother of the facetious painter Paul Sandby, an architectural critic and draftsman, read occasional lectures on architecture in the Academy; but of his works and lectures we have no records. His brother Paul, an amiable, agreeable, and facetious man, and a considerable artist for his period, was among the earliest R.A.'s, and doubtless persuaded his brother Thomas to read Vitruvius and Palladio, and to transmute their stern lessons on their art into agreeable essays, suited to the mixed assembly of painters, sculptors, incipient architects, engravers, drawing masters, and others, who were admitted as members, associates, and students, to draw from the antique and living figure, and to listen to the biennial discourses of Reynolds, and the annual platitudes of Penny, R.A., Professor of Painting, of whom we have no more room than to say, that he painted the death of General Wolfe with all nude figures,—modern drapery being in his opinion beneath the dignity of an historic pencil;* the clever compilations of Thomas Sandby on architecture, and the few but earnest prelections on anatomy by the celebrated Dr. Hunter. Wisely then did

* This work is still preserved, among some really fine works of art, in the Picture Gallery at Oxford.

Wyatt determine to increase his store by visiting the academies, schools, and buildings of France and Italy; and the result was, that on his return to his native country he gave proofs of a taste that wanted nothing but a visit to the still more refined climes of Greece to have completed. But alas, a residence in that country, owing to the wars between the Turks and Venetians, and other turbulences, rendered it even more unsafe than it was in the time when Stuart and his fellow travellers visited that afflicted and long-suffering country. On his return to his native land, he astonished the connoisseurs and travelled patricians of England, by his first work, the Pantheon in Oxford-street, a work which more deserved the name of the building it professed to imitate than any other in Europe, as pictures and engravings still extant sufficiently prove. It required but to have been built of more substantial materials than was the timber cupola, niggardly allowed him by the proprietors, to have rendered the Pantheon of London incomparably the best imitation of that of Rome. The best part of this fine work, the cupola and all its decorations, was unfortunately destroyed by fire, and was never afterwards adequately restored. After its re-instatement, it was used as a saloon for masquerades, ridottos, and exhibitions of pictures, and once of Lunardi's monster balloon, which was constructed to ascend with fifty people. The upper half alone of this stupendous machine reached from the eye of the cupola, from which it was suspended, nearly to the pavement, as was witnessed by the writer of this article. The superior part of the balloon was to have represented the cupola of a temple, from which was suspended a circular tambour of cloth, painted in imitation of columns and entablature of the Corinthian order, to complete the peristyle. At the base of this was to have been attached a gallery with pedestals and balusters for the æronauts, with doors to the interior of the peristyle, leading to the car which carried the furnace and fuel,—it being on Montgolfier's principle, of rarified air produced and supported by fire. The Pantheon was afterwards converted into a dramatic theatre, for the exclusive performance of English opera, but it was put down by the managers of the patent theatres, by arresting some of the leading performers, of whom one or two had been members of the Covent-garden company. After many vicissitudes, it has been nearly rebuilt as to its interior construction, and used as a bazaar for the sale of works of art and fancy articles.

The front of the Pantheon next Oxford-street consisted of two slightly-projecting wings, and an Ionic portico projecting from the receding centre, the upper part of which was finished by a balustrade, and was covered by a terrace which was entered by a large central Venetian window. The whole façade was marked by a timidity of design more befitting a student than a master of his art; wanting boldness and a greater diversity of light and shade. The Ionic order of the portico bore marks, however, of an attempt at invention, being copied from no known example. It singularly enough fell into the flat volutes of the Greeks, instead of the angular volutes of the Romans, proving that if Wyatt had not seen the temple of the Apollo Dedymæus, he could at least compose a more tasteful capital than he had seen in Rome; which he certainly did far above any Roman example, but far indeed below the purity of the worst of the Greek specimens.

Wyatt not only surprised the admirers of architecture by this work, but also by his designs and drawings that he brought from Italy, and the extensive knowledge he possessed of the arts in general. His polished manners and numerous polite accomplishments gave facility to the development of his ideas, and secured him a host of patrons and friends among the great. He became the principal architect of the day; was consulted by all the leading peers and commoners of the two kingdoms who were about to build, enlarge, or improve their mansions; corporations sent to him for designs for town-halls and assembly-rooms; bishops for new palaces; deans and chapters for repairs of their cathedrals; and players for designs for theatres. In fact, Sir Christopher Wren had scarcely more employers or more buildings in hand at one time, than had James Wyatt in the zenith of his employment.

At the death of Sir William Chambers, Wyatt succeeded to his chair in the office of surveyor-general of the Board of Works, and was admitted to that easy familiarity and confidential intercourse with his royal master, George III., surpassing even that of his predecessor, whom the king always regarded with somewhat of the respect due to a tutor. Indeed, the intercourse which is necessary between a sovereign and his chief architect was as complete between George the Third and James Wyatt as was possible between two such persons; the king never desiring to be treated by any one whom he condescended to consult otherwise than as an English gentleman, and Wyatt was too well bred to be either servile or pert: indeed, the familiarity that existed between Charles the Second and Sir Christopher Wren much resembled it, except that in this case the king was occasionally too much of a roisterer, and loved to indulge in a few jokes upon his little architect's want of sesquipedalian stature;—that between George the Fourth and John Nash was as professionally perfect, except that here the king was too well bred to notice, in his walks with his little architect in the crowded saloons of Carlton-house, the difference of their stature, any more than he did when he was walking with his little friend, Count Boruwlaski. For these, if an apology be necessary, we must have recourse to Churchill, who says—

> "Before such merits all defects must fly,
> Pritchard's genteel and Garrick six feet high."

The before-mentioned qualifications possessed by James Wyatt, till then unknown in one man since the days of Jones and Wren, had previously to the accession of George III. led to the employment of Italian architects, now reverted through the influence of that sovereign into English channels. Possessed of genius, taste, and feeling, Wyatt revived a correct style, and introduced one still purer than any of his predecessors,—remote, it is true, from all the transcendent purity of the genuine Greek school, but nearer approaching to it than the best Italian known. The ancient architecture of England, the neglected and almost forgotten Gothic, came, by desire of his sovereign, under Wyatt's investigation. Here was a new field opened to him; but he had seen many of the finest Gothic cathedrals of France and Northern Italy in his travels, and the style was therefore not so new to him as to Wren. Nor did he so thoroughly despise it as Wren: yet he never comprehended it in all its exquisite niceties. The restoration of Windsor-castle and the repairs necessary to be done to the venerable cathedral of its diocess, Salisbury, led both the monarch and his architect to close Vitruvius, Palladio, Serlio, and all books treating on the "five orders of architecture," for a time, and to open Dugdale and other musty writers on the cathedrals and castellated buildings of England. The additions to Windsor-castle show that Wyatt thought that if he could not amend he would not alter the original styles of the buildings, and he completed these labours with great credit to himself and to the entire satisfaction of his royal and munificent patron. The celebrated abbey at Fonthill, which was erected entirely from his designs, for the rich and tasteful Beckford, the celebrated author of "Vathek," was a brilliant instance of Wyatt's genius, but was not so pedantically correct in its details as to please the hypercritics of the Camden school. The tower was lofty and imposing in effect, visible at a great distance, as was the intention of its proprietor; its apartments were numerous, gorgeous, and elegant, replete with all those exquisite niceties that so marked the fancies of Beckford, and was a vast shrine, cabinet, or jewel-case, filled to every corner with gems of art and literature of the most precious description that the lordly wealth of its splendid owner could cram into it. The design and execution of this unique building reflect the greatest credit both upon the talents and taste of its architect. Its unfortunate fate is too well known to be described here, but the enquiring reader may be fully gratified as to its plan, general effect, and details, in Mr. Britton's elaborate and careful work on Fonthill-abbey.

Wyatt's greatest offences against the rigid laws of Gothic architecture are the exterior of the palace at Kew, and the west front of the Parliament-houses that were burned down some few years since. Both consisted of a series of sash windows and piers, in the manner of any common dwelling-house, *Gothicised* as plasterers call it by Roman cement, splayed reveals, Gothic water tables over the apertures, a splayed coved moulding over the upper tier, and a series of little port-holes by way of a parapet. The arcade or cloister to the House of Commons was below criticism. Although the style of these two buildings receive the *sobriquet* of the Wyatt-Gothic, it is more than surmised that a higher power had a hand in it and Wyatt bore the blame. His houses, villas, and mansions are among the most convenient, splendid, and tasteful in the country, and bear upon their face that their builders were not their own architects. As an instance of his power of combining splendour and elegance with comfort and convenience, uniting the state-rooms of the Italian palace (where one room is but a passage to another) with the comforts of an English mansion, which was often rendered intricate by too many passages for the sake of privacy, Wyatt's own mansion, at the western end of Foley-place, with its two well projecting wings that gave it the complete appearance of a town house, and its garden-front next Portland-place looking like a country villa, is a forcible instance. I have often visited it in the architect's life-time, when my late friend and fellow-student, John Westmacott, a younger brother of Sir Richard Westmacott, R.A., was his pupil. I have since revisited it about five years ago,

and can bear testimony to the truth of this assertion. It is a pity that the family of this eminent architect do not permit some competent person of leisure and talent to publish some of the choicest of their father's works, the size of the "Vitruvius Brittannicus," for the use of the architectural students of the present day. In the eastern front of this mansion, Mr. Wyatt has used that very elegant specimen of the Corinthian order without modillions in the entablature, and with the horns of the abacus of the capital coming to a point, instead of being cut off immediately above the volute, as in every other known specimen, given in Stuart' "Antiquities of Athens." This is the only instance, I believe, of this order ever having been used since the time of the Athenians, and is a proof of Wyatt's great taste in seeing the beauties of Athenian architecture through the works of Stuart. The capital, however, loses much of its fine effect by being made the finial of an attached pilaster, instead of a detached column as in the original. A popular legend was common, soon after the completion of this mansion, among the office boys and junior pupils in architect's offices, which proves how much it was the admiration of the travelled cognoscenti of England,—which was, that Mr. Wyatt had as many rooms in his house as there were styles in architecture, each appropriated to an order or style; the Tuscan in the basement, the Doric on the ground-floor, and so on upwards: which was as near the truth as Isabey's belief that Fuseli, who was notoriously fond of nice cookery, lived upon raw beef-steaks, to encourage those horrible phantasies of the brain with which he stored his pictures.

One more instance of Wyatt's great power to arrange the apartments of an English mansion will suffice to show how much this portion of his works would pay for their contemplation by the aspiring student for architectural fame. It is Ardbraccan-house, near Navan, in the county of Meath, the palace of the bishop of that diocess. In its exterior it is a plain, well-proportioned, gentlemanly-looking edifice, with the windows and their intervals in harmonious relation to each other. The customs of the Irish prelacy oftener causes their residences to be filled with visitors on the occasions of ordinations, meetings of the clergy at the cathedral (always near to the palace), and other public gatherings, than is usual in England. Irish hospitality also leads them to follow the scriptural exhortation for bishops to use hospitality, who not only invite their clerical brethren to take their bed and board at the palace, an invitation which is always extended to the wives, and sometimes to the brothers and sisters of the invited, but Irish custom allows barrack-rooms on such festive occasions, which causes a dozen or a score perhaps of single men being placed together, as close as beds will admit, into one room, and a similar establishment for single lasses on the women's side of the house. The whole establishment is, in fact, on these occasions, like a barrack on a small scale, and good quarters found for every one, there being often no inn in the place or for miles round. I was an inmate at this house for some weeks, on the invitation of the late bishop of Meath (Dr. O'Beirne), whilst writing my life of Sir Christopher Wren,—Miss Wren, the great granddaughter of our illustrious architect, having been for many years domiciled with Mrs. O'Beirne, in the bishop's family. The lady would not trust her manuscripts to the uncertain risks of perils by land and by water in their transmissions to and from Ardbraccan and London; therefore, as the mountain would not come to Mahomet, Mahomet was obliged to go to the mountain. There it was I first became acquainted with this peculiar characteristic of Wyatt's architecture, and sorry am I now that I did not take a plan of at least its principal story; but I was occupied entirely with other objects. The worthy prelate, a tasteful and a travelled man, the friend of the Duke of Portland, Lord Shelburne, Charles Fox, Sheridan, and other illustrious men of his age, was proud of his house and his friend Wyatt, and often pointed out both to me as models to follow. He called his house an elastic, an expansive, a contractile house, for when opening all its apartments and arranging them according to art, he could by closing certain doors, and excluding certain passages and apartments, reduce it to the very moderate size that his small and unostentatious family required, and with as much comfort as if residing in a house no larger than they wanted for themselves. My apartments, consisting of a sleeping and dressing room, and a sitting room, where I wrote and had all the Wren papers entrusted to me, communicated with the bishop's library. This suite of apartments, so complete in itself, was as private and detached from the other part of the house as a set of chambers in the Temple; and if I was ever called upon to leave my study without time to put away my papers, I could either lock that room or at the end of an outer passage the whole suite, so that no one could enter them but myself, and yet they could all be made subservient to the hospitable purposes of an Irish ordination.

James Wyatt received and educated many pupils, some of whom obtained eminence, as may be mentioned hereafter, and not a few are enrolled in the list of gold and silver medallists, emblazoned originally by that elegant penman, Tomkins, and continued to the present time, that hangs framed and glazed among the records of the Royal Academy. The portrait of this eminent penman, who surpassed all his predecessors in this line of art, and has been equalled by none since, was the last that Reynolds ever painted. Mr. Wyatt was never knighted, whether it was ever offered is unknown; but it may have been declined on account of his being a widower. He was elected a fellow of the Royal Society, much to the annoyance of Sir Joseph Banks, its then president, who preferred twaddlers and titled nonentities to men of genius, whom he feared would discover his shallow pretensions to fill the chair, so gloriously occupied in by-gone days by Brouncker, Wren, and Newton. Wyatt was one year, during a misunderstanding among the Royal Academicians, as to which of their important selves should supersede Benjamin West, who was then growing aged, in the presidential chair, elected president without his knowledge. It was upon this or a similar occasion that Fuseli, who wanted a younger and more effective president than the aged painter of the death of Wolfe, wrote in his ballotting paper the name of Mary Lloyd. One of West's supporters asking the sarcastic Swiss why he voted for an old woman, he replied, "Why should I not vote for one old wooman as well as anoder?" Wyatt proved a perfect *King Log* during his reign, for he never troubled either himself or them, and on the few nights that he ever took the chair at a lecture, he fell asleep during its delivery, to the great amusement of the students, who laughed at every oscillation of the presidential cocked hat from shoulder to shoulder. This propensity to doze after dinner was unconquerable in poor Wyatt, who indulged it even at Beckford's table, the most entertaining man of his day, when Nelson was present, interesting the whole party by the recital of his hair-breadth 'scapes and gallant deeds performed by himself and his valiant brothers in arms in the then recently fought battle of the Nile. *Honor est á Nilo;* not so thought the lethargic architect, for he dozed, and dozed, and dozed again.

This eminent man was unfortunately overthrown in his carriage, on a return from Windsor, from the effects of which he never recovered. The office of surveyor-general of the Board of Works, as held under the crown from Inigo Jones and other eminent architects to his death, has never since been filled up; some of its duties having devolved upon the office of Woods an Forests, and others being filled up by special appointment of the crown, or acts of parliament, as in the cases of Sir Jeffery Wyatville, and Messrs. Nash, Blore, and Barry.

(To be continued.)

THE BRITISH MUSEUM.

No. III.

The collection of Etruscan antiquities carries the mind back to a most interesting period, that of a people possessing a high degree of civilization, and a great extent of political power, the masters of the Iberian seas, the teachers of the Roman commonwealth. Yet of such a people the chief records are those monuments now before us in the Museum. Of their origin, their language, their political institutions, and their history, we know almost as little as if they were pre-Adamites;—so unstable is human power, so fickle is human glory, so great the vicissitudes of national progress. In this Museum we have, however, before us the liveliest paintings of their persons, their dress, and their manners; and the scholar will be able in time to restore the Etruscans on the page of history, as he is now able to restore the Egyptians and the Assyrians. Thus the jealousy and neglect of the Romans, although for so long they overshadowed the Etruscans, will not be able to hide them from us for ever; perhaps also we may in the end make the monuments of Africa speak of those other rivals, the Carthaginians, whom Roman envy has shrouded in darkness. Had the Romans told us more, we should have had less to discover, and less pride in the success of our endeavours.

The origin of the Etruscans is at present involved in doubt—the legends of the ancients have the air of fables, the discussions of the moderns want the support of facts. We can neither admit of a Lydian origin nor can we refute it, and we must know more of the early history of Italy before we can assign the exact value to facts or conjectures. Nevertheless, it does not seem beyond the compass of sound historic synthesis to enable us to solve the problem of Etruscan origin; and this must be done to allow us to

determine that of the Romans, for notwithstanding all that has been written, this latter question is by no means set at rest.

If we avail ourselves of the comparison of facts in other countries, we shall first have to learn the events affecting the Celts, for that these were settlers before the Pelasgians appears, from the names of the rivers and mountains, and from other such signs, very certain. It is moreover much more likely that the Pelasgians and Etruscans should drive the Celts back, as the Germani did on the Rhine, and the Belgians in Britain, than that the Celts should drive the Pelasgians from Cisalpine Gaul. Although we have very strong assertions of this latter event, we have every reason for not admitting them in their full bearing. Gauls might have passed the Alps, and settled in a Celtic country, weakened perhaps by war with the Etruscans; and this will satisfy to the full the declarations of the Roman historians, while it will be in accordance with historic science.

The spread of the Pelasgian tribes would cause the withdrawal of the Celts; and we can then conceive, in accordance with what took place in Greece, that the new settlements would receive the elements of civilization from the busy spirits of Phœnicia and the centres of the arts, who sought, among ruder people, the field of distinction which at home was already too crowded.

If we allow for a Celtic action in Italy, we ought likewise to be prepared for a Germanic influence. This alone will account for some of the phenomena affecting the Romans, for which Pelasgic or Greek causes are incompetent. Allowing to the full for the indirect action of Greek civilization through Etruria, Rome certainly owed little to the Greek spirit.

That Etruria had a very close fellowship with Greece is certain, and her sea trade would help this, but we are not therefore to admit that Etrurian civilization is purely a Greek derivative. The people represented to us in the Museum, particularly those in the paintings from the tomb at Vulci, found in 1832, have so little of a European cast, and so much greater likeness to the Indo-Persic and Syriac types, that we can hardly refuse to acknowledge some eastern influence. It might be said that the Etruscan artists adopted an artificial or conventional type, as the Greeks for instance did with regard to the form of the eye. Those, however, who will take the trouble to compare, will find that there is every difference between the grim outlines of early Greek art, and the paintings of the Etruscans. In the several specimens we have of the latter, the same portraiture is not observed throughout, and there is difference enough between the personages of Vulci and those of Tarquinii to enable us to determine that the paintings are in portraiture of a people, and not in simple conformity with a conventional type. The paintings from Vulci present us with an eye, nose, and profile belonging to those people who now and then lived in the west of Asia, and the features in the Vulci paintings are as strongly marked as the features of Arabs, in some of the Egyptian paintings of Rameses II. or Seti-Menephtha, in the adjoining rooms. It may perhaps be said that the representations of the Etruscan Charon in the Bronze Room are conventional, but these are more strongly marked—the nose is a large aquiline nose, like that of the Syrian or Arab race. The countenances represented in the Tarquinian paintings approach nearer to a Pelasgic type, but are peculiar in their formation.

From what we know of the Etruscans, it is by no means incompatible with facts, that they may have received a civilization independent from that of the Greeks. The Phœnicians we know ranged the Iberian seas, as well as the Ionian, and it was quite competent for a Cadmus to carry Phœnician letters to Etruria as to Thebes. It is much more satisfactory to suppose that the Etruscans and Greeks drew from a common spring, than to suppose that the Etruscans drew only through the Greeks. There was an intercourse between the Phœnicians and Etruscans as between the Phœnicians and Greeks--for anything we know, a greater intercourse between the former, while the Etruscans were susceptible enough of cultivation, that they were hardly likely to have been unimpressed with their first visitors, the Phœnicians, and to have waited for the Greeks before they took the seeds of civilization. There was no sympathy of language to cause a greater favour for the Greeks, for the Etruscans were decidedly not Greeks, whatever kindred they bore to the Pelasgic family. Commerce with the Phœnicians would account for the likenesses between the Etruscans and Greeks, as well as for the differences. The Etruscans would draw from the same springs of letters, arts, laws, manners, and belief, as the Greeks did, and it is as easy to picture the growth of Etruria, as of Athens, Corinth, or Thebes; while after-intercourse with Greece would fashion a greater likeness between Etruria and Greece, as intercourse between the cities of Greece brought them to one common form of civilization. There could have been no large Greek settlement in Etruria, or we should have had results equivalent to those of Magna Grecia or Massilia, instead of being able to trace only general proofs of Greek intercourse and influence.

Perhaps a large fusion of Phœnician blood determined the formation of the Etrurian people, though we must not expect to find an equal influence throughout Etruria. The prevalence of so many large commonwealths shows that Etruria rose, as Greece did, from the gradual development of separate settlements, which would each possess a distinctive character. Hence we are able, even in the few remains we have in the Museum, to trace great differences between the works of Tarquinii and those of Vulci. A Phœnician settlement would account for the Etruscan taste for shipping and sea trade, and perhaps for other characteristics. If we allow of such a settlement, yet we need not suppose that it would permanently influence the language or national features; for a small body of settlers among a larger people would be absorbed, as the Longbeards were in the north of Italy, and the Northmen were in the south. This is a simple explanation of a common historical phenomenon; but where the foreign population is concentrated, as the Jews in the Ghetti, and the Greeks in South Naples, national characteristics may be long preserved even among a small community.

The study of Etruscan antiquities is likely to have a special value as illustrating the early history of Rome, which is now hidden in mist. The Etruscans were a highly-polished people when Rome was a nest of robbers; and from Etruria was derived much of the laws, learning, manners, and belief of the Romans. It is an interesting historical investigation to determine how Rome, of late growth, succeeded in undermining and upsetting Etruria, though we can acknowledge that it was effected as much by the greater moral vigour of the former, as by any other circumstances.

The Etruscan collections in the British Museum comprise several stone tombs, a vast number of vases, and copies of large paintings from the inside of tombs. In these latter we have represented, with all the vigour of life, the domestic manners and public games of the Etruscans, and there is not in the Museum any collection which is in this respect so complete or so interesting. The paintings and bas-reliefs relating to the Egyptians, Greeks, or Persians, are fragmentary, except the frieze from the Parthenon, a work wonderful in itself, but teaching us little of the Athenians as a people. In the tombs from Tarquinii we have however banquets and public games, wherein men and women are represented in all the brightness and distinctness of colour. We have the dresses, the furniture, the vessels, the animals, the instruments, and these, as well as the persons, drawn so naturally, as to leave nothing to be desired for our well-understanding of the home life of this long-lost people. Subjects so varied offer of course many illustrations of the habits of the people, and on one of the Tarquinian tombs we have all the public games in which the people indulged. Although the representations from the Egyptian tombs are painted, and often enable us to distinguish portraits, national characteristics, and details of dress, yet their conventional execution wants the charm of the Etruscan designs. Seti-Menephtha, of a colossal size, occupies the greater part of a picture, and attacks a chief of the Tahennu, who again overtops the people, who in diminutive shape are scattered in the corners of the panel. The Egyptians, moreover, want life, even if in any degree they comply with the requisites of a likeness to the human form. They are curious, but are not pleasing; whereas the works of the Etruscans have both qualities, and are the expression of a very agreeable type of civilization.

The Etruscan collection in the British Museum was chiefly formed by Signor S. Campanari, who explored many tombs in Etruria, and made copies of the paintings. The whole of these were exhibited for some time in London and other towns, under the name of the Etruscan Tombs, as will be remembered by those who saw them some few years ago. The Trustees of the British Museum showed a very laudable exercise of judgment in purchasing this collection from Signor Campanari, and securing it for England. Besides the Campanari collection there are great numbers of vases of various dates and styles, purchased or received by the Trustees, and which include many Etruscan specimens.

The collection may be considered as forming three parts. 1st. The paintings from the tombs. 2nd. The sculptured tombs. 3rd. The vases and terracottas. It is to the paintings we shall direct our attention chiefly on the present occasion.

They include four principal divisions, two in the Etruscan Room, and two in the Bronze Room. The paintings are placed on the walls above the cases, but the figures are of sufficient size to allow of their being well seen. Each subject contains the paintings on the inner walls of a tomb, and above is shown the ceiling of the tomb. The decorations therefore which once lined four walls, are now spread out flat lengthwise, which is well suited to display the grouping. On account of the distribution around the walls, the composition is arranged into a centre group, with one on each side, the remaining space being left for the doorway.

In the Etruscan Room both subjects are from the ancient city of Tarquinii. We are obliged to distinguish them as the Right Tomb and the Left Tomb, according to their situation on entering the room. The Left Tomb includes three couples banquetting, attended by ten musicians and dancers, five on each side. The Right Tomb is in two compartments, and includes in the lower compartment three couples banquetting, attended by twelve musicians and dancers. In the upper compartment, or over the heads of the banquetting party, is a long subject with smaller figures, which represents all the varieties of public games, with two stages of spectators looking on. In the Bronze Room are two tombs from Vulci. That on the left has male figures, with Etruscan inscriptions, engaged in various games; that on the right is very much mutilated, and the subject cannot be ascertained. Two seated figures seem to be Pluto and Proserpine. This is in a very different style as to countenance and treatment than the others, more nearly approaching the Greek style.

Besides these four principal subjects are some smaller. In the Etruscan Room are paintings from a tomb at Corneto, including a woman paying the last offices to an old man stretched on a bier, two men drinking and dancing, and men drinking and playing on the double tibia. In the Bronze Room are two paintings of the Etruscan Charon, from the entrances of tombs, with Etruscan inscriptions. Most of our readers are aware that the Etruscan character is of a Greek type, and used in the method originally obtained from Phœnicia, of writing from right to left, instead of the later Greek way of writing from left to right.

The Right Tomb from Vulci is so different in style that we must speak of it separately, but the other tombs may be classed together. There is a smoothness and ease in the style which is particularly remarkable, and great care in the drawing of forms, though there is no attempt at minute anatomical delineation. Whether the figure is draped or naked, the same practice is adhered to of drawing in the outlines of the figure, which, when the figure is draped, are shown under the drapery. This has a singular effect, as however closely or loosely the male or female figure may be clad, the naked body is shown through the clothing, not in the mere pressure of the drapery, but in the exact anatomy, however far the drapery may be distant. Thus, in the figures on the Left Tomb of Tarquinii, where the dancing women are clad in a kind of full-skirted modern petticoat, the whole of the lower limbs are rigidly drawn.

This practice shows how sensitive the artists and the public were to a close and accurate delineation of the human figure, and how very different from our modern artists and public. The frequent exhibition of the naked figure in public games made the Etruscans more critical in human anatomy, and as we have no longer the same opportunities, it is only by a close study of the antique and of the living model that we can hope to make up for our deficiencies. The Etruscan paintings well illustrate the soundness of that law, put forward for all classes of art, from high art to the least mechanical performance, that instruction must rest on the study of the human figure. Schools of design may draw from architectural casts as long as they like, and make as much use as they please of the rule and compasses, but we cannot have artists or an artistic public without the figure. This must be at the beginning of teaching, and it must follow it throughout. This fact was proclaimed ten years ago, and our schools of design will never enable us to compete with foreign manufacturers in works of taste, until we carry it out fully and faithfully.

To make a high artist, all will allow that nature must be studied—but what does this mean? Are we to draw trees and flowers, and to neglect that noblest organization, the human form? The Greeks and the Etruscans walked among trees and flowers as we do, they enjoyed the beauties of the landscape—but they did not thus become artists, nor could they have become artists. A flower is most admirably organised, so is an animal; but the perfection of organization, the adaptation of physical means to intellectual ends, is man. It is in his form, in his structure, that we can study the highest applications of godlike skill,—and to neglect this, is to neglect the greatest and noblest school of art. Anything so perversely blind as English practice on this head cannot be imagined, and it conveys the causes of English failure. In England, the artist is a mechanic in painting, nearly on a footing with a Wolverhampton lockmaker or nailer, who goes on from year to year copying the same article, without reference to any higher principles. The Commissioners of Fine Arts, in fostering good drawing and correct anatomy, do most wisely for the interests of art; and it is to be hoped that all will unite in the same purpose, and that in our academies and schools of design we shall follow the only sound course of teaching and learning. The great end and aim of all teaching is to train the mind to the best habits, whatever may be the end of the learner, whether high or low; and in a right education, the mind of the statesman and the porter, the artist and the workman, will be equally trained in correct thinking, whatever may be the special object of their pursuits.

The Etruscan figures are of two classes, draped and naked; but none of the female figures are wholly naked, though some are naked from the waist upward. The drapery is so various in its structure and adaptation, as to afford much practice to the artist, and he has the whole range from the naked figure to the complex forms of modern female fashion. The garment most used by men and women is an oblong square shawl or mawd, worn in various ways. Sometimes it is a shawl or scarf. Sometimes a cloak, with the men a waistcloth. As a scarf, it is sometimes put on in the usual fashion, and the ends then put through the arms, so as to hang down. As all the garments are of various colours, white, blue, and red, and sometimes with braiding, patterns, and ornaments, the effect is much increased.

Many of the female dresses are very elegant in form and colour, and they are of great variety. We recommend to the ballet masters, who are always searching for something novel, an Etruscan ballet, with some of the picturesque costumes of the Museum. In each subject a different general fashion is observable. In the Right Tomb of Tarquinii, the women have a long and rather close dress, with a shawl; a cap worn in the fashion Parisian women wear a coloured kerchief, with short curls. They have likewise sandals. In the Left Tomb of Tarquinii, the costume is almost modern—a boddice with short sleeves, a short and very full petticoat, boots or sandals, long hair worn with a wreath, earrings, bracelets. The third fashion is in the tomb of Corneto: a boddice, petticoat, pelisse, cloak or shawl, long-toed shoes, the hair worn in long tresses.

As an example of the mode of treatment, we may take the female playing the castanets, in the Left Tomb of Tarquinii. She wears a red boddice, edged with bright blue, short sleeves of the pattern of the skirt, trimmed with blue. The petticoat, short and in full breadths or folds, is of a reddish tinge. The pattern is in red, and consists of three spots divided by horizontal stripes or braid of red, sometimes plain, sometimes dentelated. The pattern of the skirt would do credit to Regent-street, and shows more design than most of the products of the Manchester loom. On her shoulders she wears a blue scarf edged with red, the ends being, as before described, brought through the arms. Her hair is worn long, and around her head she has a blue wreath. Her boots are red. She has bracelets, and in her ears rings with a large round drop.

Besides the practice of showing the outline under the drapery, there is another conventional peculiarity of Etruscan art, which consists in showing all the fingers of the hands, which are arranged in perspective, fan-fashion, but close together.

In the Right Tomb of Tarquinii, in the lower compartment, the chief personages are three men and three women, seated in couples on three couches, which are laid in one row, so that the guests can be fully seen by the spectator. Throughout the subjects we notice that the women, like those of Rome, were treated with great deference and attention, being the companions of their husbands in their feasts and games, and that they held the position of a Germanic rather than of a Greek wife. In the banquets and the games the women are present, seated with the men; and even of the slaves or attendants, none of the women are naked. Two naked boy attendants stand near the couches, and there are small tables, of very elegant design, bearing refreshments: the men and women are drinking. As if for coolness, the men and women are naked from the waist upward.

Under each of the couches is a pair of ducks, painted in blue. Each of the ducks is in a different posture, but each is characteristic, and the artist shows a degree of skill and fancy which a modern rival could not surpass. The six ducks are pictures in themselves. From the introduction of them, it is to be supposed they were pets of the household, though rather strange ones.

It is to be noticed that the Etruscan artists studiously strive to introduce as much variety as possible in the treatment. While a general symmetry of arrangement is preserved, each figure is put in a different dress or attitude. So, too, the details are varied. If one dancer is in blue, another is in red; if one has a shawl, another has a cloak, and so forth. In the Left Tomb of Tarquinii, the figures of the dancers are separated by trees, on which are birds or animals; but there is a different set for each tree.

At one end of the couches is the chief musician, playing on the double tibia or pipes. This seems to have been the great instrument of the Etruscans, as it was afterwards with the Romans. It is introduced, likewise, in the Left Tomb of Tarquinii. The instruments shown are the double tibia, the lyre, and the castanets. In each subject are two players of the double tibia.

On the left hand are three male and three female dancers, and as many on the right hand. One of these latter plays the double pipe. The figures are separated by branches of trees. The men are without shoes, and with no garment but a waistcloth.

On the right-hand side is an elegant table with three white vases and one red one. This is a pleasing furniture group.

The upper compartment of this tomb contains a great number of groups and figures of small size, engaged in public games, and with two stands for spectators. The stand has a platform, on which are the chief personages, men and women. Underneath are some men lying down. The costumes of the spectators show a greater variety of fashions than the banquet; some of the men have beards, and some are without; some of the women are dressed in white.

The games represent leaping, running, chariot races, hurling the discus, boxing, and the armed course, which are painted in a lively manner.

In a kind of pediment above is a large vase, and two persons at an entertainment.

The entrance to this tomb is adorned with two panthers.

The Left Tomb of Tarquinii only includes one subject—a banquet; but the costumes are much richer. To this belongs the female figure already closely described. Here, likewise, the chief personages are three couple seated on couches; but the arrangement is different, one of the couches being turned lengthwise at right angles. This gives the opportunity of seeing the finish of the end—and indeed the design and finish of the couches are well worthy of study, showing fitness, lightness, and elegance. Here are two small tables or stands, exquisitely finished, on which are placed the refreshments. A female attendant is standing. A naked page holds in his hand a percolated vase or wine-strainer. Male and female attendants seem to have been employed at entertainments. Two of the lady guests wear a red veil. The whole of the guests are wreathed either with ivy or laurel. Under the couches is a panther, a cock, and a hen. The cock is a very gay piece of painting, and is another example of the attention to details. The panther seems to have been a great favourite of the Etruscans, and here and elsewhere is frequently introduced. He was of course, tamed. The men in this group wear short beards, whereas, in the other Tarquinian tomb, the guests are beardless. On the left of the couches stands the player of the double tibia.

On the left-hand side are two male and three female dancers. One of the men is playing the lyre. On the right-hand side are likewise two male and three female dancers. One of the men plays the double tibia, and one of the women the castanets, or rather bones. At each end is a man, mounted either on a mule or horse. Each figure of the side groups is separated by a tree, chiefly laurel, having sometimes a flower at the bottom. On the branches, and flying around the trees, are birds of gaudy plum . On some of the trees beasts are drawn, as the panther, rabbit, and fox. These latter are painted spotted, like the panther. One of the panthers is climbing a tree, like a cat or a monkey. The men dancers wear blue mawds, and the women dancers red mawds. The fancy displayed in the arrangement of all the details is well worthy of note. The drapery is likewise pleasing.

The Left Tomb at Vulci, which has Etruscan inscriptions, is of a more oriental character in the features of the people. There are no women in this subject, and the figures are employed in public games, as leaping, running, horse-racing, &c. Some of the men wear a cap, like that of the women in the Right Tarquinian Tomb. The Vulci Tomb was discovered in 1832.

The Right Tomb at Vulci is different from all the others in subject, style, treatment, and physiognomy. The personages, who are more of a Greek or Pelasgic character, are closely draped in cloaks of one colour, as blue, without ornaments or trimming,—more closely approaching what from our sculptural impressions is conventionally required as antique, than the gay and lively costumes of Tarquinii. This tomb, however, had a chequered ceiling, like those of the Tarquinian tombs. These ceilings are of a peculiar character, and are executed in various colours, showing, as usual, much fancy in the arrangement.

The paintings of the Etruscan Charon are coarse, and seem conventional caricatures or grotesques, quite different from the portrait-like character of the other designs.

The Etruscan paintings will well repay inspection, and are some of the best illustrations we have of ancient manners. The student who wants a comment on Homer will best find it here, and after perusing the book of games, he cannot do better than see them depicted in detail in the Right Tarquinian Tomb or Left Tomb of Vulci. The banquet scenes are fair illustrations of Roman life. Etruscan vases and Etruscan dancers, the double flute and the lyre, were to be seen at Roman banquets, where the guests likewise reclined. What is given merely in form in bas-reliefs is here given in form and colour; and what is in sculpture performed by the artist from imagination, long after the event, is here painted to the life from the men and women as they breathed and moved and dressed. Certainly, the Elgin frieze gives us a tamer idea of Athenian life, though executed under the eye of a Phidias, than the weaker paintings of the Etruscans do of Etruscan life.

In an artistical point of view, there is a benefit in studying the works of a refined people, for so the Etruscans were. They possessed a literature, and inscriptions were common on public works, showing that reading was generally diffused. Their dresses, manners, and games show that they possessed wealth and cultivation, and the works they have left us are ample proofs of their advanced taste and of their love of the pictorial arts. Music and dancing were advanced to the rank of arts. It is always useful to contemplate and analyse the progress of a people who had less advantages than ourselves.

The sculptured tombs in the lower part of the Museum do not show so favourably as the paintings, though they exhibit traces of artistic development. They are generally carved in soft, bad stone, and some are in coarse clay; yet, even in these, there is an attention to anatomy, to drawing, and to drapery, which draws our notice. Some of the reclining figures show considerable care in the arrangement of the muscles of the back. In the paintings, minute anatomical drawing is not attempted, but in the Right Tomb from Vulci the muscles of the abdomen are drawn in the Greek style in the figure of Pluto, which is only half-draped. From their progress in painting, from their sound principles of art, and from the indications in the rude sculptured works we have, we may rest assured that these latter are not fair samples of Etruscan art; and we may expect, that though most of the finer works have perished by the effect of time or by the hands of the Romans, that more favourable specimens will yet be discovered.

The vases commonly called Etruscan, are now brought together in the Etruscan Room, and arranged, which was very needful, for during some years they remained in a deplorable state of confusion, so that it was impossible for the student to get any benefit from them.

The vases are now arranged chronologically and according to the localities in which they are found. They form six groups, besides a collection of terracottas, chiefly Etruscan.

The first group consists of vases of heavy black ware, some with rude figures upon them in low relief, the work of the ancient Etruscans. These are mostly found at Cervetri or Cære.

The second group includes the vases called Nolan-Egyptian or Phœnician, with pale backgrounds and figures in a reddish maroon colour. The figures are chiefly those of animals. These vases are mostly found at Nola.

The third group contains early vases with black figures upon red or orange grounds. These are rich in mythological subjects. These vases are found at Vulci, Canino, and the Ponte della Badia, to the north of Rome.

The fourth group is formed of vases more carefully finished. The districts from which these are obtained are Canino and Nola.

The fifth group is a later class of works, more slovenly painted. The subjects relate chiefly to Bacchus. The vases are got from the province of

he Basilicata in Naples, to the south of Rome. Indeed, most of the vases are got over a wide district, far beyond the confines of Etruria Proper.

The sixth group is from the Neapolitan province of Puglia or Apulia. These are much like the vases of Nola, with pale backgrounds and figures of the reddish maroon.

The terracottas are of various origin and require classification, so that the locality may be known. They are chiefly Etruscan. In the centre of this group are various divinities and mythological groups.

Besides the vases included in the Etruscan Room, are others in various parts of the Museum. There is a large collection of vases and terracottas from Athens in the Bronze Room. In the Townley collection are Roman vases, urns, and terracottas. In the Egyptian Rooms are vases and similar works, of various times and styles.

Altogether, the collection of vases and terracottas in the Museum is copious, but to make it complete it is very necessary that there should be a series of Chinese porcelains. The Museum of Economic Geology contains some specimens of ancient and modern earthenware, but the British Museum must be looked to as the chief school for artists.

(To be continued.)

DESCRIPTION OF A UNIVERSAL TIME TABLE.

By F. Bashforth, Esq.

The calculation of Railway Time Tables is attended with considerable difficulty and liability to error, owing to the various velocities of different classes of trains and the variation of gradients and stations stopped at. The importance of the correctness of these tables, coupled with the difficulty of obtaining that result, have led me to contrive a little instrument which, when the stoppages and the time of starting and arrival are determined, will give the times of arrival at each station exactly as they appear in the bill, regard being had to varying gradients, and consequently varying velocities. There could be no doubt of the perfect success of a mere geometrical contrivance, but to remove any doubt that might be felt, and to explain my notions to my friends, I have constructed a universal time table for the main line of the Manchester and Leeds Railway, which is about 61 miles long, and has 21 stations. The result is perfectly satisfactory. I employ two scales; the vertical is of 40 minutes—the horizontal of 8 miles to the inch, but they might have been respectively 60 and 20. The instrument is arranged on a board 11 inches square.

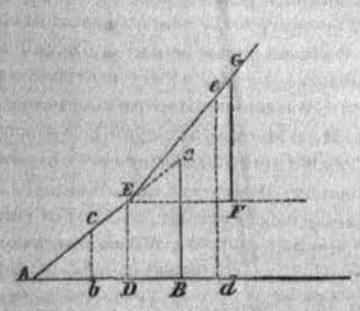


Fig. 1.

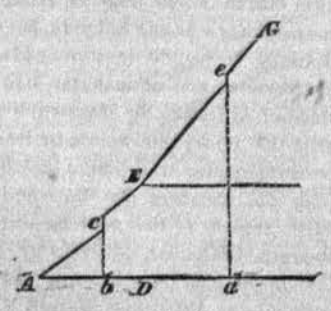


Fig. 2.

Let A B, fig. 1, represent 30 miles, and the perpendicular C B, 60 minutes, and suppose a train to be travelling along A B with a uniform velocity of 30 miles per hour. The time of describing A b will be found by applying the vertical scale to measure the perpendicular $c\,b$; for

$$\frac{\text{Time in A } b}{\text{Time in A B}} = \frac{\text{A } b}{\text{A B}} = \frac{b\ c}{\text{B C}}.$$

But B C represents time in A B, and therefore $b\,c$ represents time in A b; and so on for any other distance.

Suppose, however, that when the train comes to D, the velocity falls from 30 to 20 miles per hour. Draw E F parallel to A B, and cut off E F = 20 miles. Erect the perpendicular F G, and make it 60 minutes by the vertical scale. Join E G. Then the time of arrival at any point d, will be found by applying the vertical scale to the perpendicular $e\,d$, and reading off the minutes; and so on if there be more changes of velocity.

The above is applicable to a train travelling with varying velocities, bu without stoppages. If we suppose the train to lose 5 minutes by stop ping at a station at b, then this time will never be recovered, and every point in the time line to the right of $b\,c$, must be raised 5 minutes. If there be another loss of 4 minutes at d, every point in the time line to the right of $d\,e$, must be raised through 4 minutes additional; and so on for other stoppages.

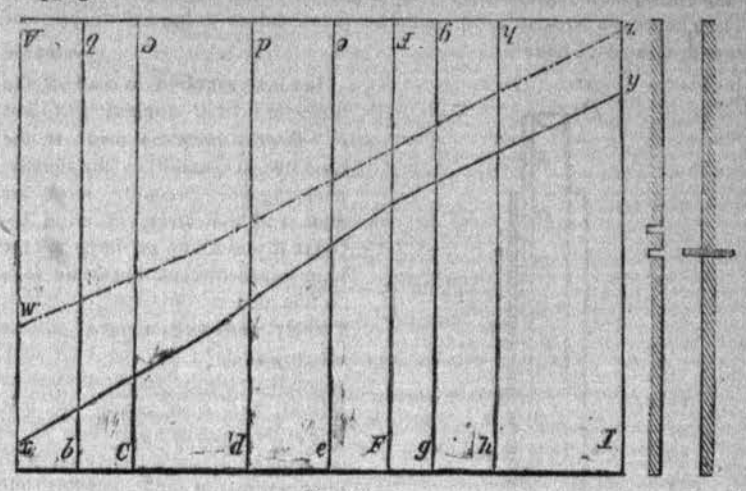


Fig. 3.

Fig. 6.

Suppose that on a railway there are stations A, b, C, d, e, F, g, h, I where A and I, are the termini, and C, F, first class. A to b, is 3 miles; to C, 2½; C to d, 5½; d to e, 4; e to F, 3; F to g, 2; g to h, 3; and h to I, 6 miles. The first eight miles can be travelled at the rate of 25 miles per hour, the next ten at 20 miles, and the remaining distance at 30 miles per hour. Fig. 3, shows a series of strips of boxwood of equal length and thickness, but whose breadths represent the distances betwixt the stations, measured by the horizontal scale. The section at fig. 6, show the provision made at each division, by a pin and two holes, to allow fo stoppages, as at C and F, fig. 4. The time lines, $x\,y$, $z\,w$, are laid down as in fig. 1. The former is for trains passing from A to I, the latter from I to A.

Fig. 4.

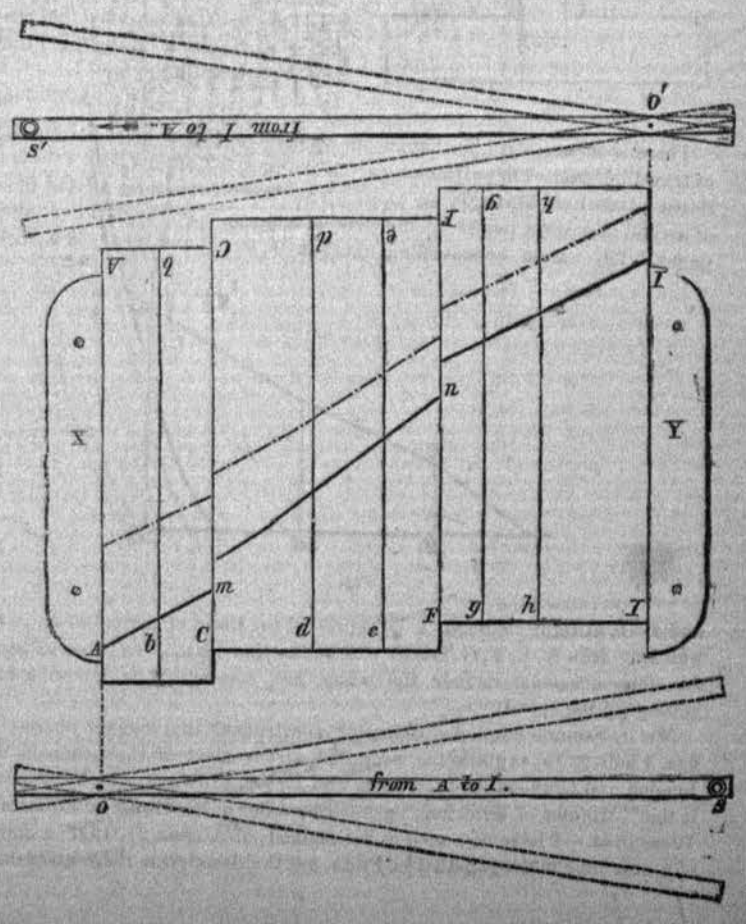


Fig. 3, is placed on a level surface as in fig. 4, and the separate pieces of wood are kept in their places by two fixed pieces X Y, with parallel faces. O S, O′ S′, are two straight bars moveable about O O′, capable of being clamped in any position. Fig. 5, represents the sca le used in reading off the time. The head moves along the bars O S, O′ S like a T-square. The slide carries divisions for every 10 minutes, and the circles on it represent the ivory studs on which any required consecutive hours are written, as it would be inconvenient to have it of sufficient engih to hold 12 hours.

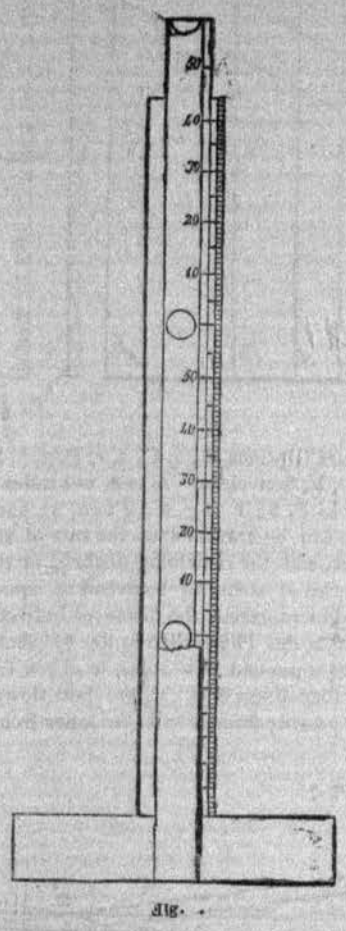


Fig. 4.

Let it be required to read off the times for a train stopping at C and F. Breaks must be made in the time line at C and F, by the contrivance, fig. 6. Secondly, move the slide and the strips of wood betwixt X and Y, up or down till the time of starting on the scale falls n the end of the time line at A. Thirdly, move O S, about O, till the other extremity of the time line coincides with the required time of arrival, and then clamp the bar. The scale must be applied to show the hour and minute coinciding with the breaks at *m* and *n*, and this time must be registered in the table. For the return train, I to A, the head of the scale slides along O′ S′, and the second and third adjustments have to be made.

Few stations have been supposed for illustration, although the advantage of using this method is not so apparent in such a case. However great the number of stoppages, it is scarcely possible to make a mistake that will not be detected. If any error be made in making the breaks in the time line, the time table will show either the omission or excess, as the time and station must be read off at each break in the time line, and registered in the tan

There is no necessity for having the velocity per hour given for the rate of travelling over each particular part of the line, for the purpose of laying down a time line, as it may be plotted from the observations of the times of arrival at several points of the line of a train travelling without stoppages. Let train be travelling along A D, fig. 7, and let O, B E, C F,

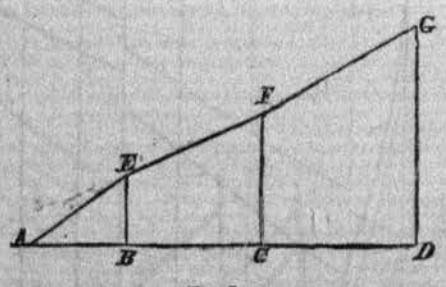


Fig. 7.

and D G, at right angles to A D, represent the times of arrival at A, *b*, C, and D. Join A, E, F, G, which will be the time line. The time allowed for stoppages must include the whole loss consequent on lowering and getting up the speed.

Mr. J. Samuda employed diagrams constructed in a manner similar to figs. 1 and 2, to explain the proposed arrangement of the trains on the London and Croydon, and Croydon and Epsom railways, which are given in the "Minutes of Evidence," printed by order of the House of Commons, June, 1844. I have also seen in the *Builder*, of August 21, 1847, a notice of a new time table, patented in Paris, but the description there given does not enable me to say whether it resembles the one above described. I am not aware that the method of allowing for a stoppage at any given station, for varying the time of performing the journey, or for reading off the times ready for insertion in the time table has ever before been adopted.

ENGINEERING AND RAILWAY MEMBERS OF PARLIAMENT.

A new parliament under usual circumstances is not of much importance to professional men, but for once the case is different. Engineers and surveyors have now much at stake in the measures likely to be subjects of legislation; while the elections have brought forward many men whose opinions on these subjects, or whose connection with our professional pursuits, create much interest. We have been handed over to the mercies of a Board of Trade already, while many measures deeply affecting professional interests are sure to come under discussion, such as the health of towns' bill, a general act for drainage, railway legislation, the survey of London, and steam-engine inspection. How these subjects are likely to be treated is not unnaturally a matter of anxiety.

The last parliament began the new class of railway directors, for we can hardly consider the election of Mr. Charles Russell, the late member for Reading, and chairman of the Great Western railway, as being of more value than a single and accidental circumstance. It was the return of Mr. Hudson and Mr. Chaplin which constituted the class now so greatly increased by the late elections.

With some it has been a matter of fear that we should have a railway parliament, and it has been put forward, under the authority of Mr. Dodd, that the present parliament contains more railway directors, engineers, retail tradesmen, and political lecturers than any former parliament, and fewer officers in the army and navy, and landed gentry. If a parliament now have railway directors in it, it must have more than in former parliaments, because as it may be said railway directors did not exist as a class in former days. We might as well be told that in the streets of London there are more cabmen and omnibus-drivers than in former days, and that on the river there are more steamboat stokers and fewer watermen. Admitting the fact that there are more railway directors and engineers in the house, we do not therefore see any ground of alarm to the country. As to the retail tradesmen we have little to do with them, except so far as they have been mixed up with railway directors, and insomuch we are bound to say that we put no worth on the increase of retail tradesmen, for we believe that the whole body of retail tradesmen in the House of Commons consists of one or two individuals. The injury to the country cannot at the worst be very great in having Mr. Williams, the haberdasher, instead of Mr. Alderman Waithman, the haberdasher, or Mr. Alderman Sidney instead of Alderman Sir Matthew Wood. We confess likewise to obtuseness as to the injury likely to arise from Mr. Alderman Sidney, Mr. Williams, or anybody else who makes money behind a counter, sitting cheek by jowl with the members for Waterford county, Finsbury, and Wallingford. With regard to the political lecturers, they mean Mr. W. J. Fox, Mr. Feargus O'Connor, Mr. George Thompson, and Mr. Wilson; and even though political lecturing has taken the place of political pamphleteering, it grieves us little that Messrs. Fox and Thompson sit as members of the house to which Burke, Sheridan, O'Connell, Cobbett, and Hunt belonged. We need not enlarge the latter list.

The only fact with which we have to grapple, indeed the head and front of the grievance, is the number of railway personages; though we are bound to say, that when admitting the new classification of railway directors, we must not forget that it strips Mr. Hudson of his quality as a landed proprietor, Mr. Glyn of his title as a banker, and every other individual of his previous description of enrolment. One question therefore is, whether in accepting the new class of railway men, we admit a body less wealthy than officers in the army and navy, government functionaries, or landed gentlemen. We believe that on the whole Mr. Hudson, Mr. Glyn, Mr Robert Stephenson, Mr. Cubitt, Mr. Chaplin, Mr. Parker, Mr. Locke, Mr. Peto, Mr. Waddington, Sir Joshua Walmsley, Mr. Jackson, &c., have not too small a stake in the property of the country to disqualify them from sitting on the same benches with other gentlemen, whose names it is unnecessary to mention, as the state of their finances may be learned of any

low bill-broker or sheriff's officer. If we were to give a cool and candid opinion, we should say that the present parliament contains as much wealth, respectability, and intelligence as any parliament which has ever sat within the precincts of St. Stephen's. We are quite ready to believe that there are adventurers in the present house, but we do not believe that there are more than usual in an assembly to which the mode of admission affords no guarantee of moral worth, still less a security against moral corruption.

There is a class of persons in this country and in all others, who so far from allowing that there is nothing new under the sun, can scarcely believe that the night falls and morning breaks day by day, and that the whole scheme of creation, life and death, death and life, rolls on in the course of its accomplishment. For them, everything that is new is a prodigy and an alarm, and they are kept in a perpetual state of worry by the untoward events of their times. No hen was ever more alarmed at seeing ducklings take to the water, no schoolboy was ever more annoyed at a wet holiday when he had nailed the barometer to "set fair," than are the class to whom we have alluded, at the obstinate movement of a state of society which in their mind's eyes they have nailed to stand stock still. For them, the irruption of railway men into the House of Commons is a new cause of wonder, and we shall have a new Sybil or a new Coningsby on a fact which sets itself so audaciously against the middle ages, and which is only a new proof of the material aspect of these degenerate days. Alas! the House of Commons has been always in this state of revolution. It began by admitting the small squirearchy, the manorial lords who rose under the Edwards; it received an accession of traders under the Tudors, of Puritans under the Stuarts, and of army colonels under the Cromwells. Queen Anne's people were taken aback by the admission of stock-jobbers and fundholders, King George's by the strange accummulation of nabobs; then we were frightened by West India planters, by bankers, those who had enriched themselves with government contracts, and by horde upon horde of the *nouveaux riches* who had enriched themselves *tout nouvellement*. The vested interests in the house are all innovations: there were no army officers before there was a standing army, no country bankers within a century, no fundholders before there was a national debt, and the staticians have made no allowance for the decline or extinction of lottery office-keepers, West India planters, government contractors, and nabobs. The accession of railway chairmen and directors is a fact, and "*un fait accompli*," but no more; the House of Lords will not be turned into a first-class train, the House of Commons into a second-class train, nor will Mr. George Hudson be made First Lord of the Treasury, nor Mr. Chaplin Commander-in-Chief. It is a great pity for those who have excited themselves to the pitch, but there will be no railway revolution.

All that it amounts to, and the only real significance is this, that those who were before distributed among the squires, bankers, and merchants are now grouped as railway directors, and that we have admitted a new classification of men of wealth, ability and intelligence. So far as investigation may be entered upon, we are sure that the result will be to show undoubtedly that as a nation we are none the worse off than we were before; though, by conforming with the wants and exigencies of the times, we may be in some degree the better.

Whether we will or no, conform we must to the progress of events; we cannot fasten old habits on to new institutions; there is no travelling outside an express train, nor can it be made to stop for a parcel of game at a hall door,—all that stage-coach system has been done away with. The electric telegraph will not frank ladies' gloves and fans, nor can we give West India pines a hot-house flavour. New establishments create new institutions. Railway companies have created railway directors, and railway directors have become members of parliament;—we must submit, and not be surprised when the next change comes. We may soon have telegraph men as candidates, and the successful management of the correspondence of the country may be a claim for the honours of representation—and why not? What harm is done?

By some the mention of railway members of parliament is met by the counter-cry, "What can the management of switches and sidings have to do with legislation, or why is successful jobbing to be held as a proper training?" Certainly, if England were a country of doctrinaires, which it is not,—or an empire of mandarins, which it is not,—or a Prussian police district, which it is not,—railway directors would as such have no qualification, and they would be bound to prove the extent of their political studies and capacity. We are not aware of any free country being successfully governed by literati or theoretical politicians, and both Rome and England are examples of countries not governed by literati; nor do we think that the latter country is likely to come under the system. We must therefore take it as we find it, and in so doing, it may be worth while to consider how far railway directors as such are likely to prove efficient law-makers and public counsellors.

England is a practical country, and a preference is always given to practical training over theoretical training, and we question whether Englishmen would not any day much sooner elect a good brickmaker than the greatest poet or dramatist on whose fame they ever prided themselves. Give a man a good practical training, and he may set his hand to anything—that is, the English teaching and schooling: and we are none the worse for it. It is perfectly national to see Richard Cobden and George Hudson in their present positions, and it would not be surprising to find them exercising still greater influence. The standing of these two is an exposition of the national sympathies and character—not what some have been pleased to call it, the worship of Mammon, but the result of that innate appreciation which the English have of business habits applied to business purposes. We are very certain that as much would not be done for Charles Dickens, and we are not ashamed of it. Dickens has his reward in another way. We give to a Cobden or a Hudson political power and influence, but we do not award to them the undying esteem of all ages. It is the pride of genius to labour for the applause of posterity; the politician has only a life interest in the present. Whether it be better to become a Shakspeare or a Cobden it lies with the aspirant to judge, but he must not complain if he do not receive the rewards of both. We know that there is a large party who complain that in this country literary and scientific men do not receive political rewards; we cannot see that there is any ground for sympathy with this complaint. We think a successful railway potentate much more fitted for a law-maker than a proficient poet, physician, or artist. A man who can look well after his own affairs is, in the common acceptation, best fitted to look after the affairs of his neighbours; and railway kings comply much better with this condition than poets, painters, mathematicians, musicians, or actors. The sample we have had of literary men in the House of Commons has not been encouraging enough to induce us to wish for more; and while there is no specific exclusion of them, and while they have the means of purchasing a qualification by the very liberal remuneration of their labours, we are not disheartened nor ashamed that Dickens, Ainsworth, James, Leigh Hunt, and Sheridan Knowles, are not members of the House of Commons. It is quite as open to them as it is to Bulwer, D'Israeli, and Macaulay; and when they can command the political confidence of the public, let them demand political honours.

We consider the training of a railway man as particularly qualifying him or parliamentary duties. He must be a man in whose pecuniary ability and trustworthiness a large number of persons have placed their confidence. He *is* trained in the habit and feeling of public responsibility and accountability. He must have working habits of business as the member of a board, for without he has adequate command of temper and ability, he cannot continue as the colleague of a dozen or twenty men of standing. The crotchetty, prattling, meddling, or ill-tempered man is either sifted out, or he has his rough points polished off. He acquires a considerable degree of financial and fiscal knowledge in dealing with large sums of money. He is compelled to enter upon the consideration and application of many newly developed principles, which require close discussion and accurate comprehension. He is schooled in meeting the exigencies of new and progressive institutions. He is called upon to conduct important negotiations with able men, and to make arrangements which shall be applicable to circumstances of great difficulty and complexity. This is no exaggeration of the capabilities of a railway man, and we consider it not a bad stock whereon to engraft the responsibilities of a seat in the House of Commons.

Except among our Indian functionaries of the civil service, it will be difficult to find men who have had a wider field of administrative practice than our railway directors. Responsibilities far exceeding those of the finance minister of many an independent nation devolve upon Mr. Glyn, or Mr. Hudson. The yearly expenditure of millions, the management of a floating capital of twenty millions, and of a current revenue perhaps of two millions, with the administrative control of a thousand subordinates, afford a wide field for the attainment and exercise of practical ability,—and we opine that that is what is wanted in the House of Commons. We have speakers enough and writers enough; we want thinkers and doers, and the more of them th better.

A fair examination of the question can only have one result—the recognition of the eligibility of railway men, even if we cannot get so far beyond the fear of ridicule as to allow their superior capacity. We believe the present

House of Commons has been refreshed with new blood, and that Mr. Macgregor, Mr. Fox, and Mr. Wilson will not prove useless members, still less Mr. Glyn, Mr. Hudson, and the many other gentlemen whom we have already enumerated. Before leaving this part of the subject, however, we cannot well refrain from making some remarks on a few of the individuals most prominent in the railway legion.

Mr. George Carr Glyn is the son and grandson of a baronetal family of that name, and a member of the banking firm in which his brother, the present baronet, is a partner. Mr. Glyn made his debut in joint-stock companies during the mania of 1824, at which time, among other such occupations, he was auditor of the Columbian Pearl Fishery company—one not among the brightest enterprises of that speculative period. Of late years he has shown less ardour in his engagements. In the next great period of speculation, we find him chairman of the London and Birmingham, now the London and North Western railway company. For a long time he has been the head, out of parliament, of the railway interest; as much from being put forward by his colleagues, as from being recognised by many of the minor companies. His policy in this capacity is the index of his parliamentary policy, and it has not been that which in our view has been best calculated to promote railway interests. Mr. Glyn has no confidence in independent action, and has always been inclined to lean upon the government. He was the introducer and the chief supporter of the Board of Trade inspection system, and his last public act is a declaration of his adhesion to the same principles, though he has already had reason to regret the exercise of the power which he has entrusted to such hands. Mr. Glyn has no defined views as to the operations of railway capital, the principle of private enterprise in joint-stock companies, or the principle of fares. What convictions he has are opposed to what is assumed to be the best theory and the best practice, and Mr. Glyn only acts in conformity with these latter, when he can no longer withhold his action, though he does not seem to give his acquiescence. With a very distinct delivery, and a seeming logical severity of language, Mr. Glyn is a very indistinct thinker. As a railway chairman, with the prestige of a great reputation, and with a case carefully got up, Mr. Glyn has been an impressive speaker. Whether he will be so successful in the House of Commons, where he will no longer stand alone, but have to contend with other men, remains to be seen. Undoubtedly he has great advantages: a pleasing person, polished language, a confident but inoffensive address, and the assertion of high moral principle, when backed by power and reputation, are calculated to produce a favourable impression on an audience. On some points of religious profession, Mr. Glyn is, we believe, likely to take the same part as his cousin, Mr. Plumptre, whose strong opinions are well known. Success and ill-success have been about equally balanced in Mr. Glyn's career: the resignation of the North Midland chair, defeat by the Great Western, and recriminations with Mr. Moss and Mr. Russell, in which mutual charges of breach of faith have been bandied, have been counterpoised by Mr. Glyn's maintenance of the London and Birmingham chair, and by his amalgamation of the Grand Junction railway, after difficulties which might well have been regarded as insurmountable. Mr. Glyn's maiden session will be anxiously watched by many.

Of Mr. Hudson little need be said. He has successfully passed through an anxious railway session, and the next series of half-yearly meetings can scarcely present anything inauspicious. The prestige of his reputation is untouched, while in the present temper of the Bentinck party, being unshackled in his political movements, and released from his patronage of protectionism, he is likely to exercise great and useful influence in the house. Mr. Hudson is certainly the railway man of the most original powers of thought, of the most advanced mind, and of the most progressive character. More confidence is to be placed in his single defence of the joint stock system, than in that of all the railway members put together.

Mr. Hayter is the representative of the Great Western.

Mr. Chaplin is a man who will hereafter be better understood by the public. A sketch of him in *Fraser's Magazine*, does honour to him and to the writer. Mr. Chaplin is a man who by great prudence has raised himself to a very high position, who undertakes nothing without careful and laborious thought, and who, although often behind hand and not always in the right, commands respect from the known fact that his opinions are the result of a well-studied conviction. Mr. Chaplin, we conceive, is much more likely for the present to follow Mr. Glyn's line of policy than any other; for he is, like Mr. Glyn, only a forced follower—we cannot say convert—of what may be called the railway movement party.

Mr. David Waddington has not hitherto been well known in any independent capacity. His chief claim heretofore has been the unbounded confidence reposed in him by Mr. Hudson, and his administration under Mr. Hudson of the Eastern Counties railway, against the most difficult circumstances.

Mr. Robert Stephenson, the son of the patriarch of the locomotive system, has been less known by the public in his personal capacity than as an engineer. His ability in those gladiatorial combats before parliamentary committees, his practice in negotiation and correspondence, and the confidence reposed in his diplomatic skill by leading railway men, are guarantees of his powers to those who know him. A good figure and pleasing address will help him in making an impression in the House of Commons. He has always been acting in conjunction with Mr. Glyn.

Mr Locke has tried his skill in the same arena of the committee-rooms, and with equal success. Mr. Locke at one time co-operated with the Great Western in their struggle with the London and Birmingham, but still must be ranked among Mr. Glyn's followers.

Mr. Jackson, of Birkenhead, has only a provincial reputation. He is a fluent speaker in the Liverpool style, but is likely to require a long training in the House of Commons before he will have weight. He has no decided views on general principles of railway policy, but is an advocate for non-restriction in currency matters. He has no weight among the railway interest, and will not be admitted by them as an exponent of their views, whatever course he may adopt.

Sir Joshua Walmsley is a Liverpool merchant, a colleague of Mr. Jackson's. He has served the office of mayor of Liverpool, when he was knighted. He is likewise a fluent speaker.

Mr. William Cubitt, the contractor and builder, not the engineer, will not, it is supposed, take any active part in parliamentary proceedings.

Mr. Samuel Morton Peto is considered a man of education, ability, intelligence, and practical business habits. He speaks well, but his railway principles are not known.

Mr. Wyld has never had any intimate connexion with railway management, but is well acquainted with the general policy, and is supposed to be an advocate for non-interference.

Mr. Humphrey Brown was the founder of the Birmingham and Gloucester railway, and afterwards its manager. He enters with very strong feeling into every subject he takes up. He is not so well liked as a speaker out of doors, but in the House of Commons is likely to be well listened to, as he is a well-skilled statician, and can get up his case carefully and studiously. He leans to non-interference in the management of joint-stock enterprise.

There are abundance of railway directors in the house, but very few others who are likely to take part in debates in such capacity beyond those we have named. As the matter stands, we fear the prospects of the railway interests are very uncertain, for in all likelihood the voices and votes of Mr. Glyn, Mr. Hudson, Mr. Chaplin, Mr. Locke, Mr. Stephenson, and Mr. Waddington may all be given for a Board of Trade bill, or for more stringent standing orders to restrict new companies: This, however, is matter of speculation, for Mr. Hudson is far on the way, as already intimated, to repudiation of the Board of Trade, and he last year vehemently condemned their railway bill. If, then, they should bring in some measure trenching too much on the vested interests, they would only have the support of Mr. Glyn and Mr. Robert Stephenson, and the government would find itself attacked by Mr. Hudson, Mr. Chaplin, Mr. Hayter, Mr. Waddington, Mr. Locke, Mr. Peto, Mr. Jackson, Mr. Humphrey Brown, Mr. Wyld, and Sir Joshua Walmsley. This would make a grand railway debate; and a severe defeat of Mr. Strutt might jeopardise the ministry.

We must intreat the railway members carefully to consider the mischiefs which have already accrued from Board-of-Trade interferences, to withstand every new bill, and to repeal or modify all the restrictions which have been placed upon joint-stock enterprise by the standing orders and enactments, such as the length of notices to parliament, the ten per cent. deposit, the limits on the payment of interest on calls, on the amount of dividends and fares, the power of suing for calls, the registration of joint-stock companies, and all the other new-fangled devices for impeding the free progress of railway enterprise. Old companies may be fearful of encouraging competition, but experience must have already pointed out that there is only one sound way of promoting railway enterprise, old and new, and that is by unloosing the fetters. The same argument which authorises the fettering of new schemes, authorises the fettering of the old. What the companies have to fear is not competition from each other but spoliation on the part of the government. As matters are going now, there will at an early period be a demand for a limitation of dividends

which is now ten per cent., to eight per cent.; then to seven, then to six, then to five, then the commutation for government stock. Mr. Glyn and his party may think that ten per cent., under the guarantee of the government, is the best thing they can have; but they can never have it, for a government guarantee is worth nothing. It has been shown already; Mr. Hudson has denounced the breach of faith with the companies; but this is in time of peace and a mere ambitious movement on the part of Mr. Strutt; but what will the government guarantee be worth, when the ministry of the day offer, for an election bait, a reduction of railway profits and charges?—which will be an eligible measure, as it will not be at their own expense. An additional 1 per cent. on the income tax may very well be met by a diminished 2 per cent. on railway dividends,—and chancellors of the exchequer are not scrupulous on such points.

The real enemy of railway and engineering interests, and of the public interests in such matters, is the government, and they have shown it. They have ambitious ends to serve, and they do not care how they gain them. They have traded upon the unpopularity of railways, they have created a great patronage and a great influence, but what single good have they done for the public? "They have diminished railway accidents." They have done nothing of the kind. The development of the railway system has diminished accidents; but government inspection has been found to be no safeguard and no remedy: bridges fall down after they are inspected, lines are obliged to be closed, and inspectors make reports after accidents to tell the public what the newspapers tell them much better.—"They have lowered fares and tolls, and obtained better accommodation for third-class passengers." They have done no such thing, for fares are lowered in consequence of the growing conviction that the lower the fares, the larger the traffic and the greater the profits; while, by interfering with third-class accommodation, the Board of Trade has created a prejudice and indisposed the companies from extending accommodation. While the Board of Trade have done no good to the public, they have unsettled railway property; and the first thing for its safeguard is to do away with Board-of-Trade inspection altogether.

THE BLADE PROTRACTOR.

(With an Engraving, Plate XVI.)

Registered by Mr. James Basire, Jun., *of Red Lion Square.*

We have much pleasure in introducing to our readers a new and useful instrument, invented by Mr. Basire, for the purpose of facilitating the plotting of trigonometrical surveys. It is a very important improvement on the protractor, and consists in the addition of a blade fixed to the arm of the instrument, as shown at fig. 1 in the Engraving, and by the aid of which the lines are at once laid off, without the trouble of first pricking off the point, as shown in fig. 2, which in the plotting of some surveys occupies considerable time; besides which, the work is done with much greater accuracy, as it is only necessary to fix the instrument on a meridian and draw the angles at once.

For military and mining surveying, or other work set out by angles, this instrument will be invaluable, and to architects and artists of great service for copying, reducing, or enlarging drawings. In the Engraving an example is given in fig. 3, showing how the instrument is applicable for marine surveys: the blade protractor is first placed on the station A, and all the angles at once drawn off; it is then shifted to the next station B, and the angles laid off bisecting A and C; and so on.

The instruments are got up in German silver, and are furnished with four blades containing various scales, and placed in a neat and compact case, and are to be had of the inventor.

Tunnel across the St. Lawrence.—A project is spoken of in Canada, for connecting the railroad running to the Atlantic, by tunnelling the St. Lawrence, opposite the island of Montreal. The tunnel at its narrowest part, near St. Helen's Island, will be about one-third of a mile from shore to shore, and about one-third the length of the principal tunnels in England. The depth of the water in the river is 43 feet.

Dee Bridge Girders.—One of the girders of this bridge has been tested, to ascertain the breaking weight. The experiment was made on the 8th ult., by the officers of the Chester and Holyhead railway, by gradually placing railway bars over the centre division of the girder, until it reached 38 tons 6 cwt. 2 qrs. 18 lb., which broke it, the fracture commencing at the bottom flange.

SLUICE GATES AND RAILWAY LIFT BRIDGE.

Sir—At page 244 of No. 119 of your excellent *Journal*, is the description (taken from the *Franklin Journal*) of a new sluice gate, invented by F. C. Lowthorp, civil engineer, of Pennsylvania. Allow us to claim the priority of this invention for one of our countrymen, long since deceased, and thus discharge a debt due to the memory of one who directed the first steps of our professional career and who was to us both a friend and a master.

It is now about 30 years since T. Blanken, Inspecteur general du Waterstaat in Holland, well known by his grand Canal of the Helder at Amsterdam, erected in this country the first sluices with what are termed fan-gates (*à eventail, waaijerdeuren*). These gates are precisely similar to those described in your *Journal*, except that their application and the flow of water are arranged in a simpler manner than by the American engineer. The first experiments having perfectly succeeded, the king Louis Napoleon decreed that these sluices should bear the name of the inventor, and gave them the title—*Blankensluizen*.

A large number of the sluices of this country, of which the openings vary from 4 to 12 metres (13 to 39 feet), have been constructed on this principle, and their use has become general among us. M. Wiebeking has given a description of them in his large treatise on hydraulic works.

Permit us, at the same time, to claim the priority of the application of the Railway Lift Bridge, of which you give a description at page 241 of the same number. A moveable bridge, on this principle, was erected last year on the railway from the Hague to Rotterdam.

We trust, Sir, that you will have the goodness to insert this brief explanation, and beg you to receive the assurance of our perfect esteem.

(Signed) F. W. Conrad,
L. J. A. Vander Kun,
Hague, Sept. 13, 1847. (Dutch engineers.)

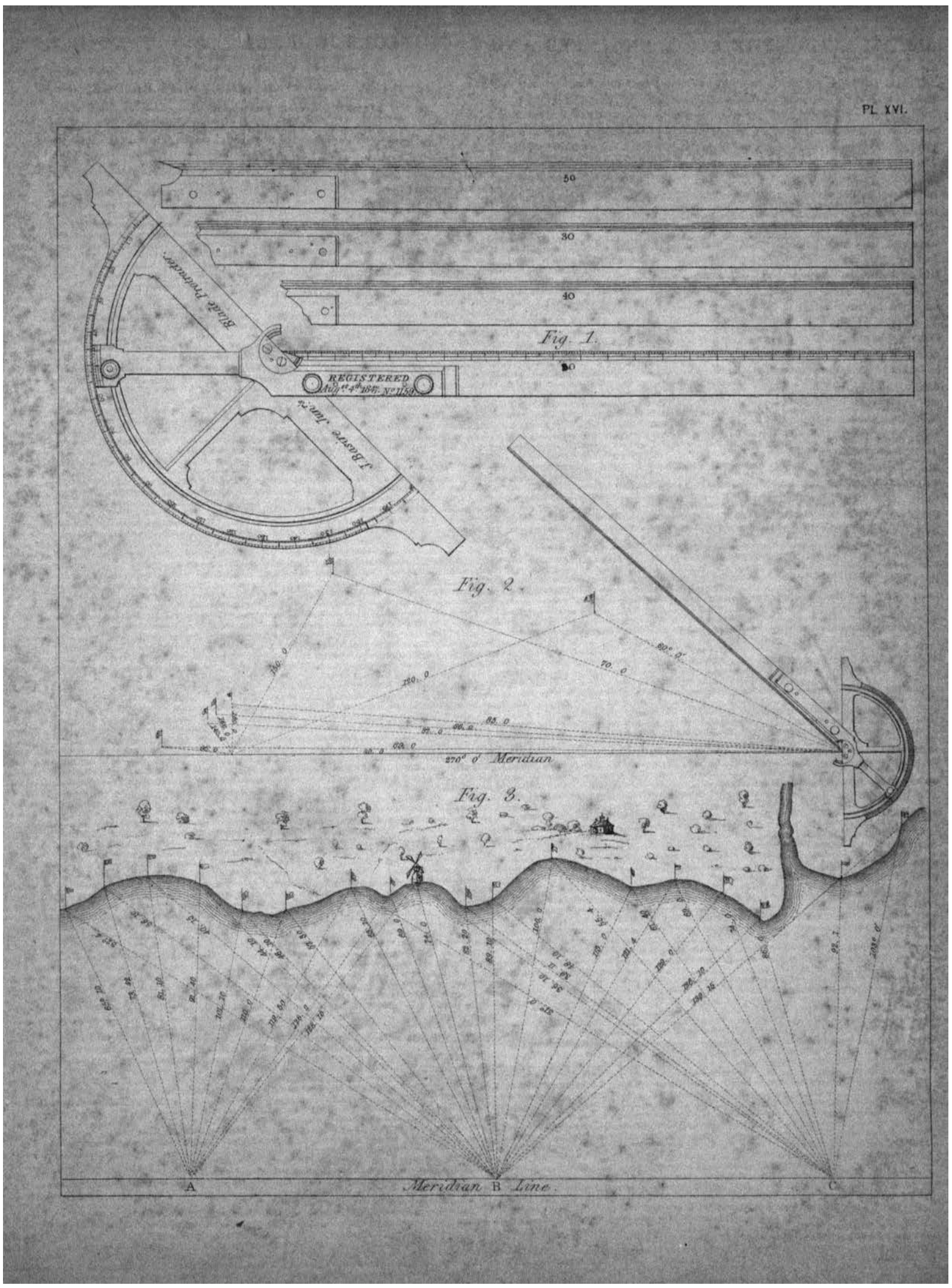
REVIEWS.

Observations on Lime, Calcareous Cements, Mortars, &c. By Major-General Sir C. W. Pasley, K.C.B. Second Edition, Part I. London: John Weale, 1847. Pp. 209.

Both the engineer and architect are under great obligations to General Pasley for the very elucid manner he has set forth in this treatise the result of many years' laborious researches and experiments on limes, mortars, and cements. When the first edition of this work appeared in 1839, we then perused it with great pleasure, and strongly recommended it to the profession; and as a proof of the correctness of our opinion, the work was very soon out of print, and has been since much sought after, which induced the author to publish a second edition. He may well be gratified to find that his laborious researches have induced several manufacturers under different appellations to manufacture the artificial cement recommended by him. The General observes in his introduction,—

"When he first published his researches on the subject, all the previous attempts to make a good artificial cement in this country had so far failed, that only one sort, that prepared by Mr. Frost, had found its way into the market, which was of inferior quality, owing chiefly to certain defects in the mode of preparing the ingredients, pointed out in the First Edition of this work. At present there are three manufactories of artificial cement in England, which have all been used more or less extensively in works of importance, and have given satisfaction; viz., first, that of Messrs. John B. White and Sons, in the parish of Swanscomb, Kent, the present proprietors of Mr. Frost's works, who, after gradually relinquishing the objectionable parts of his process, have succeeded in making a good artificial cement, which they call their Portland cement, by a mixture of chalk found on their own premises with the blue clay of the Medway; secondly, that of Messrs. Evans and Nicholson, of Manchester, who make an artificial cement, which has been called the patent lithic cement, with the very same ingredients, and in the same proportions nearly, that were used in the Author's experiments, but the most important of which is obtained in a round-about manner from the residual matters or waste of certain chemical works, instead of working with natural substances; thirdly, that of Mr. Richard Greaves, of Stratford-upon-Avon, who makes a powerful water cement, which he calls blue lias cement, by mixing a proportion of indurated clay or shale with the excellent blue lias lime of that neighbourhood, both of which are found in the same quarries; the former being previously broken and ground, and the latter burned and slaked, which is absolutely necessary in making an artificial cement from any of the hard lime stones.

PL XVI.


50
30
40
Blade Produced.
Blade Inverted.
REGISTERED
Aug.st 4th 1847. N.o 1159
Fig. 1.
Fig. 2.
270° 0' Meridian
Fig. 3.
A
Meridian B Line.
C

The success of this process, as a commercial undertaking, though the most expensive of all that were suggested in the First Edition of this work, is therefore peculiarly satisfactory, considering the great importance of good water cement, and the probability of the natural cement stones of this country, which are only found in certain localities, becoming unequal to the demand, or scarcer than they are at present."

We will now proceed to give a few extracts from the treatise, to show its practical character; first, as to the qualities of sand and lime, constituting *Mortar*.

"The sand used in making mortar should be *sharp*, that is, angular, not round, and *clean*, that is, free from all earthy matter, or other than silicious particles. Hence *Road Scrapings* always, as being a mixture of sand and mud, and *Pit Sand* generally, as being scarcely ever without a proportion of clay, should be washed before they are used, which is seldom necessary in river sand, this being cleaned by the force of the current which is the cause of its formation. None but clean sharp sand will ever form good mortar, and the intimate mixture of the sand and lime, which should be done with a moderate quantity of water, is of no less importance.

I have ascertained by repeated experiments, that one cubic foot of well-burned chalk lime, fresh from the kiln, weighing 35 lb., when well mixed with 3½ cubic feet of good river sand, and about 1½ cubic foot of water, produced about 3¾ cubic feet of as good mortar as this kind of lime is capable of forming. Some readers may be surprised that this mortar should occupy rather less space than the sand alone originally did, before the lime and water were added to it. The principal reason is, that dry sand, and all dry loose materials generally, settle into a much smaller space when wetted. Hence the same quantity of sand measured dry, then moist, and afterwards wet, will occupy unequal spaces. The clean sharp river sand, rather moist, used by us, weighed about 87 lb. per cubic foot. On gradually pouring water upon it in the measure it settled down from 12 to 9⅜ inches in height, thus occupying only four-fifths of the space, which it had before filled.

Pure lime is so little capable of resisting the action of water, that it is unfit even for the external joints of walls exposed to the common vicissitudes of the atmosphere. For by degrees the beating rains, to which the outside of such walls is subject, will gradually destroy the mortar of all those joints to a certain depth, as may be observed by inspecting old walls built with chalk lime mortar, which have not been meddled with for some years..... Walls built with the water limes settle less, and those built with cement are entirely free from this action, because the cement used in the lower courses sets too soon for the weight of brickwork or masonry added above to make any impression on the joints. Now though the difference of settlement, even between those extremes, may be very small, it does not appear prudent to use more than one species of mortar in the same horizontal joints of a building, especially as it would give trouble to the workmen, and occasion loss of time.

Pure lime mortar has sometimes been used for the backing of wharf walls, the front or facing of which has been protected by water cement, usually to the depth of about 18 inches, or two bricks thick, from the outside of the wall. Even this system, though it does not involve the entire ruin of the wall, is highly to be reprobated. The cement protects the pure lime mortar from the direct action of water in mass, but not against wet or damp, because the moisture penetrates through the pores of the brickwork and of the cement, and although not in sufficient quantity to dissolve the pure lime mortar, it effectually prevents it from setting, so that it always remains in a state of soft pulp, and is of no more use towards the consolidation of the wall than so much moist clay."

The next division of the work treats of *Plaster of Paris*, as it is generally called. To test its quality—

"Mix a small quantity of it with water in the form of a ball, and it will set with moderate heat into a very hard fine white substance, and will even continue setting under water, but being partially soluble in that liquid in process of time, it is not applicable to the purposes of hydraulic architecture."

The division on *Hydraulic Limes* describes the different limes called in London, "stone limes."

"The blue lias lime stones are considered the strongest water limes of this country, and are found on opposite sides of the Bristol Channel, near Watchet in Somersetshire, and Aberthaw in Glamorganshire, and also at Lyme Regis in Dorsetshire. The first of these, mixed with puzzolana, was used by Smeaton in building the Edystone Lighthouse. The Dorking or Merstham lime, and the Halling lime, so termed from a village on the left bank of the Medway above Rochester, but which is also found near Burham on the opposite site of the same river, though not possessing such strong hydraulic properties, are also much esteemed; and these two limes, the former of which is considered rather the best, are more used in the metropolis than the blue lias, probably from the greater proximity of the quarries where they are found, and from very little land carriage being required for either.

All the water lime stones are of a bluish grey or brown colour, which is communicated to them by the oxide of iron. They are usually termed 'stone lime' by the builders of the metropolis, to distinguish them from common chalk lime, but so far improperly, that the Dorking lime stone is not much harder than chalk, and the Halling lime stone is actually a chalk, and not harder than the pure chalk of the same neighbourhood, from which it is only distinguished in appearance by being a little darker.

In fact, all the coloured chalks found in various parts of England, commonly termed *Grey Chalks*, which are the *Lower Chalks* of the geologists, and generally free from flints, are possessed of hydraulic properties more or less powerful."

The chapter on *Concrete* contains some useful directions for mixing the ingredients, which is followed by some observations on "grouting." Among architects and builders there is a difference of opinion as to its advantages; our author's opinion appears to be favourable to its use.

"Upon this subject, I may be permitted to remark, that unless every course be grouted, it appears to me that there is a risk of the grouting not penetrating lower than the single course immediately under it, for the beds of plastic mortar in the next courses below that, have sufficient consistency to intercept the grouting, unless those beds themselves should have been imperfectly laid, which seldom or never happens, even when middling or indifferent bricklayers are employed. For this reason, one can scarcely expect sound brickwork, unless every course be grouted, especially in thick walls, although the more general custom is to work with mortar only. When one of the massy walls of the new British Museum, after being grouted in the manner before described, was cut through for some temporary purpose, it was remarked that the brickwork resisted the tools of the workmen quite as much, and appeared equally firm in the joints, as if the latter had been filled with plastic mortar instead of grouting. The same risk of part of the vertical joints being left dry may occur also in masonry, and there can be no method of guarding against it more effectual than to grout each course."

Water cement, or what is called "Roman cement," comes next. This material, we consider, has been abused in its use more than any other connected with building, and from its repeated failures in exposed situations, and particularly when used near the ground for stucco and on the top of projections, such as cornices, make one doubt its boasted durability for such works; but whether its failure be owing to the improper mixing of too much sand, or the cement being of bad quality, it is difficult to say: we may instance as a failure the balustrade enclosure on the east side of Regent's-park, which has been frequently repaired. In the construction of brick-walls, cement appears to have stood well, and might be advantageously used to a greater extent than what it is; when all circumstances are taken into consideration, the expense is not very much more than lime-mortar. General Pasley observes, that "cement" is always weakened by the addition of sand, whereas every kind of lime is improved by it. For concrete foundations it is requisite to use double the quantity of cement than is required when lime is used, consequently it is not recommended for that purpose; but for the lower parts of a wharf-wall or pier under water, one measure of cement mixed with three, and not more than four, of gravel or sand, may be advantageously used.

The valuable information communicated by the General on the manufacture of *Artificial cement* made from chalk and clay, form the most useful part of the treatise, and deserves the attentive study of all parties connected with building. We will select one or two of the author's successful experiments, detailing the process of making the artificial cement, which we here suggest should be called *Pasley's Cement*, in contra-distinction to the numerous cements which are in the market; none of which, however, appear to be superior, if equal, to the one recommended in this treatise, and which the General found to be the best after a long series of trials and experiments. The first experiment on a large scale is thus described:—

"Having, towards the close of the year 1828 and in the beginning of 1829, tried as many experiments on a small scale as I then considered necessary, I determined to prepare a considerable quantity of artificial cement composed of chalk and blue clay, with a view of applying it on a larger scale, to those purposes for which the natural cements have been used in architecture.

The chalk, after having been broken small and dried in the air, was pounded in small quantities at a time, in iron troughs that had belonged to a forge, with iron rammers made for the purpose, and was passed through sieves with brass wires, having 25 meshes to the inch, being the finest used in the Ordnance gunpowder works. A large mass of dry pulverised chalk being thus provided, 5 cubic feet of it were laid on a wooden platform, and made into a paste with a moderate quantity of water, after which 2 cubic feet of the blue clay were added, and the whole intimately mixed together on the same platform by shovels. When a sufficient quantity was prepared, the mixture was next moulded in the same manner as common bricks, excepting that water was used instead of fine sand to prevent adhesion. After these bricks of raw cement, which were twelve inches long, became drier, they were cut into five equal parts, each forming a cube of rather less than 2½ inches side, this being the average size of the lumps into which chalk is usually broken, before it is burned, in the common open lime-kilns in Kent. I made my moulds exactly 12 inches long, and $2\frac{4}{10}$ inches wide by $2\frac{4}{10}$ inches deep, in order that 25 bricks, or 125 cubes, should be exactly equal to one cubic foot. Thus, by merely

counting the number of bricks, we could ascertain the quantity of raw cement made, without the trouble of measuring it."

This experiment not proving so successful as was desired, some experiments were again made on a small scale, and subsequently on a larger scale, in a small lime-kiln about four feet diameter at top, and six feet deep.

"In this little kiln, than which nothing could have answered better, we burned, at four successive periods of the same year, about 140 cubic feet of raw cement. In the first of these batches of artificial cement we used the same mixture as before of 5 measures of chalk, 2 measures of blue clay, and half a measure of coal-dust; and in burning it, after putting in shavings and wood at the bottom of the kiln, we laid half a bushel of coals over the wood, then four bushels of the raw cubes, after which another layer of half a bushel of coals, then four bushels of cubes as before, and thus we continued applying the coals and cement cubes in alternate layers, until the kiln was filled, using one measure of coals to eight measures of raw cement, the former being broken rather small, so that no piece of coal used exceeded an inch in thickness, and both being thrown loosely into the baskets with which we measured them.

In the third and fourth batches of raw cement prepared for burning at the same kiln, we dispensed with the coal-dust altogether, using 5 measures of chalk to 2 of blue clay; and we merely pounded and sifted the chalk, without grinding the powder afterwards in the mill; and in consequence of there being no fuel combined with the raw cement in this mixture, we used one measure of coals to five measures of the raw cement cubes in burning them, which proportion we always adhered to afterwards, as the best for this mixture."

The remainder of the treatise details the numerous experiments made by the General to test the strength of all kinds of cement, to which we must refer our readers.

In conclusion, we confidently recommend an attentive perusal of this treatise to every one who may be desirous of obtaining sound practical information on limes, mortars, and cements.

Weale's Quarterly Papers on Engineering. Part I. Vol. VI. London: John Weale, High Holborn.

The present number of Mr. Weale's journal consists of three papers—I. "On the Principles and Practice of the Application of Water Power," by Robert Mallet, President of the Geological Society of Ireland.—II. "Experiments on Locomotive Engines," by MM. Gouin and Le Chatelier.—III. "Paper on the first Introduction of Steam Engines into Naval Arsenals; and Machinery set in motion thereby," by the widow of the late Sir Samuel Bentham.

The first paper contains an account of the projected Dodder Reservoirs, near Dublin, and of the Bann Reservoirs, now in course of construction. Mr. Mallet has likewise favoured us with a description of his self-regulating syphon weir, which seems to us extremely ingenious, and perfectly correct in principle, whatever it may turn out in practice.

"Over a common weir, or embankment, is thrown a large flat-shaped syphon tube, made of boiler plate, and for stiffness divided into several parallel tubes by vertical plates. One end of this syphon (which may be extended indefinitely along the crest of the weir) dips into the water ponded above the weir, the other end lays open at the lower side of the weir. The under side of the syphon tube reposes upon the crest of the weir, and the *depth of the syphon tube*, or distance vertically over *the crest*, is equal to the *height* to which the rise of water in times of flood may be permitted, (in the instance shown equal to 1½ foot).

At such a level *below* the crest of the weir as it is determined shall be the *lowest* to which the ponded water shall be wasted by the syphon, there is formed a range of air holes, or simple apertures through the upper plate of the syphon tube. The action of this arrangement is now very obvious. Whilever the water above the weir continues at the 'standard level,' none runs over or through the syphon; as its level rises above this, a sheet of water flows over the crest of the weir, and also down through the flat syphon tube, as part of the weir. This continues as the level of the water rises higher and higher, until it reaches that marked as the limit for the 'highest floods,' that is, the level of the upper side of the syphon tube. The moment the water reaches this point, the syphon, being quite full, instantly commences to act as a syphon, and discharges a quantity of water, enormously greater than before—a quantity due, not to the mere *area* of *overflow* through the partially filled syphon, but to the area of the syphon tube, and to the head of water now acting upon it as a syphon. This vastly increased discharge, now more than a match for the supply of the river itself, begins to lower the water above the weir, and its surface continues to fall until it reaches the point marked as the 'lowest level' that it shall attain. Here the range of air holes are situated, and the instant the surface of the falling water reaches these, air enters the syphon, and it directly ceases longer to act as a syphon, and becomes merely a part of the weir conducting the ordinary overflow. This process, the sudden bringing of the syphon into action when the water reaches a given level, and sudden cessation of its action again when it has fallen to a given level, may be endlessly repeated; and the effect of the syphon, when in action and suitably constructed, is in fact very nearly the same as suddenly opening a sluice, equal to its entire area, at the level of the bottom of the weir or dam."

Experiments on the discharge and flow of water from orifices and through tubes are much needed. Eytelwein's formula is generally adopted by engineers, though we much doubt whether it would be found applicable if the height of the head of water were to exceed a certain limit—say 100 or 150 feet.

The second paper—"Experiments on Locomotive Engines"—has rather a formidable appearance; the tables contain as many figures as Mr. Adams employed in the calculation of Neptune's orbit. We noticed an allusion to the fact of the difference of pressure in the cylinder and boiler being a function of the load, as a theory of M. de Pambour;—for this difference and the cause of it, we beg to observe that Nature, and not M. de Pambour, is responsible; although that gentleman, we believe, first correctly interpreted her laws on the subject.

The last paper is a highly-interesting historical summary of the labours of the late Sir Samuel Bentham.

The Indicator and Dynamometer, with their Practical Applications. By Professor Main, of Portsmouth, and Mr. Thomas Brown, Engineer. London: Hebert, 1847.

The object of this work is to explain the use of two valuable instruments for ascertaining the work done by the steam engine. The Indicator is one of the many of Watt's valuable instruments, and on which that great man set high value, on account of its simplicity and importance. By the application of the indicator the working condition of a steam engine is at once tested. The Dynamometer is introduced into screw vessels for ascertaining the amount of pressure given off by the screw shaft, and consequently the force the engine is exerting to propel the ship. The use of both these instruments and their application are very clearly explained in the little work before us.

Letter to Lord John Russell, on the Defence of the Country. By John Weale.

Mr. Weale's object is to train for soldiers all the able-bodied men who may apply for relief at the Union, and he very croakingly points out the great dangers to which England is liable from the sudden invasion of the French. We should be very sorry to see England turned into a country of bayonets; we much prefer the epithet of "a country of shop-keepers." Let men be taught how to avoid war, and not teach them the use of the carbine, to murder and pillage their fellow beings. Knowing Mr. Weale's disposition, we must say that we never suspected hat he would have recommended such a system as he has promulgated in the pamphlet before us.

COLONIAL RAILWAY PROGRESS.

Madras and Arcot Railway.—A company has been started to effect the junction of these two important points in India. The line has been highly recommended by Mr. Simms, the government engineer. Its length is 71 miles, and is nearly a dead level, the average inclination being only 1 in 633 feet; there is no tunneling, nor any cutting of consequence. The proposed line is the first stage out of Madras on the great western line of communication with Bombay and the military stations of Arcot, Bangalore, Hyderabad, Cannanore, and Trichinopoly; and is second in importance to no line in India. It will be constructed at as low a cost as £5,000 a mile.

Australian Railway and Sydney Water-Works Company.—This colony being in such a flourishing condition. It has been determined to introduce railway communication on the same economical system as practised in America. The line is intended to run from the port and town of Sydney to Richmond, passing through Paramatta, Castlereagh, Windsor, and other places of minor importance, with a branch from Paramatta to Liverpool; and it is also intended to supply Sydney with water from the hills. This is of great importance to that town, as it is at present supplied with water from a lagoon, which is almost dry in the summer season. The line is 45 miles in length, and can be constructed remarkably cheap, as government will find land, and the country abounds with a very hard and durable timber, called iron-bark wood, particularly well suited for sleepers and rails, by merely arming the edge with angle iron.

MEASUREMENT OF ANGLES.

A New Method of Measuring the Degrees, Minutes, &c., in any Rectilinear Angle, by Compasses only, without using Scale or Protractor.

By Oliver Byrne.

Let it be required to find the number of degrees, minutes, &c., in the angle A B C = θ (Fig. 1). With any radius, A C, describe a circle: then

Fig. 1.

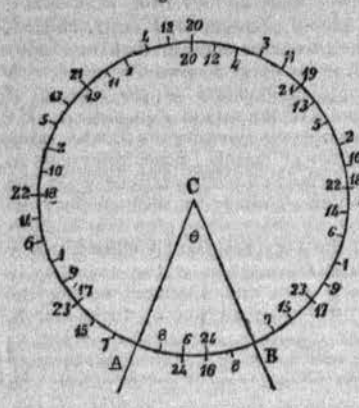
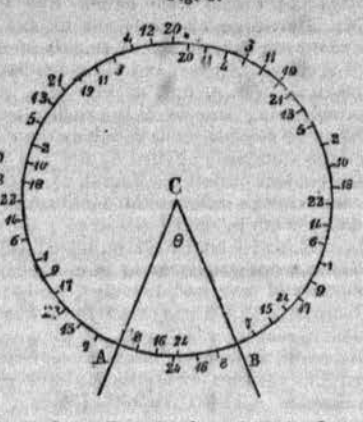


Fig. 2.



take A B in the compasses, and apply it from B to 1; from 1 to 2; from 2 to 3; &c. (the numbers outside the circle are referred to). If, in applying the arc A B, we find that on our return to B, after n applications, we have a coincidence, then it is well known that the number of degrees, &c. will be $= \frac{360}{n}$. But, in the present example, after eight applications the point falls at 8, putting Δ_1 = from 8 to B, continue to apply the same arc or opening of the compasses from 8 to 9; from 9 to 10; from 10 to 11; &c., on to 16. This process is to be continued till we have the half or more than half the arc A B between the last point found and B. In this case 24 is the point. Any error that may be involved in the process will be much neutralised by thus determining the points 8, 16, 24, &c. independently. Theoretically, the arcs B, 8; 8, 16; 16, 24; &c. are all equal, but practically they may imperceptibly differ. We might have taken the arc B, 8, and applied it from 8 to 16; from 16 to 24; &c., but this process would multiply any error that might be involved in B, 8; while the process just described has a correcting tendency. To lessen error further, we are again to begin at A, and apply the arc A B in a contrary direction, from A to 1; from 1 to 2; from 2 to 3; &c. (the numbers inside the circle are in this case referred to). Should the points 24 and 16 coincide, as in fig. 1, then we have

$$8\theta + \Delta_1 = 360^\circ; \quad \text{and } 5\Delta_1 = \theta;$$

$$\therefore \Delta_1 = 360^\circ - 8\theta = \frac{\theta}{5}; \quad \therefore 1800 - 40\theta = \theta;$$

$$\therefore \theta = \frac{1800}{41} = 43^\circ\, 54' \tfrac{6}{41}.$$

If the points 24, 24, overwrap or fall, as in fig. 2.—Then put Δ_2 = from 24 to 24: this arc will be very small in most cases—in this case it is the 20th part of A B;

$$\therefore \theta = 20\Delta_2; \quad 8\theta + \Delta_1 = 360^\circ; \quad 6\Delta_1 - 2\Delta_2 = \theta.$$

From these equations, which involve the unknown quantities θ, Δ_1, Δ_2 θ is readily eliminated.

$$\Delta_1 = 360^\circ - 8\theta, \text{ from the second;}$$

$$\text{and } \Delta_1 = \frac{\theta + 2\Delta_2}{6}, \text{ from the third.}$$

$$\therefore 2160 - 48\theta = \theta + 2\Delta_2 = \theta + \frac{\theta}{10}; \text{ since } \Delta_2 = \frac{\theta}{20}.$$

$$\therefore \theta = \frac{21600}{491} = 43^\circ\, 59' \tfrac{231}{491}.$$

If the points 24, 24, do not overwrap, as in fig. 3, and Δ_1 be in excess instead of defect, that is, that some multiple of θ made less by Δ_1 make up the circumference. In this case the three equations will stand thus:—

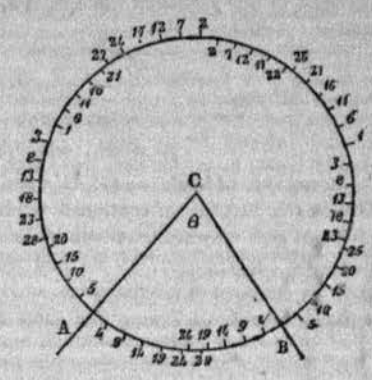
$$5\theta - \Delta_1 = 360^\circ; \quad 10\Delta_1 + \Delta_2 = \theta; \quad \text{and } 29\Delta_2 = \theta.$$

In this example, the distance between 24 and 24, or Δ_2, is found to be the 29th part of the arc A B.

$$\therefore \theta = \frac{52200}{711} = 73^\circ\, 25' \text{ nearly.}$$

It is evident that the numbers on these figures may be omitted in practice, as none of them except the first is required; indeed, where the points of the compasses rest need not be noted, except those points that fall inside the points A, B.

Fig. 3.



This method of measuring an angle is more accurate and expeditious than may at first appear from the above lengthened details, and will often be found convenient when compasses only can be obtained. A general rule may be arrived at as follows: Let

$$m\theta \pm \Delta_1 = \pi = 360^\circ; \quad n\Delta_1 \pm p\Delta_2 = \theta; \quad \text{and } q\Delta_2 = \theta;$$

be the three equations generally expressed; p being always equal + 1 or − 2.

$$\theta = \frac{nq\pi}{mnq \pm q \pm p}. \qquad (Q)$$

In example, fig. 2, this expression becomes

$$\theta = \frac{6 \times 20 \times 360}{8 \times 6 \times 20 + 20 - 2} = 43^\circ\, 59' \tfrac{1}{2}.$$

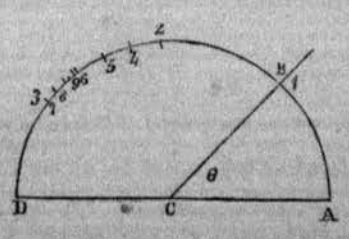
In example, fig. 3,

$$\theta = \frac{10 \times 29 \times 360}{5 \times 10 \times 29 - 29 + 1} = 73^\circ\, 25'.$$

The only thing to be observed in (Q) is the sign of q. In examples like the latter it is to be minus, but in those like the former plus.

This method of measuring angles will be found more correct than the ingenious one proposed by M. De Lagny, which consists in measuring angles with a pair of compasses, and that too without any scale whatever, except an undivided semicircle. Having any angle drawn upon paper, to measure it: produce one of the sides of the angle backwards behind the angular point; then with a pair of fine compasses describe a pretty large semicircle from the angular point as centre, cutting the sides of the proposed angle, which will intercept a part of the semicircle. Then take this intercepted part very exactly between the points of the compasses, and turn them successively over upon the arc of the semicircle, to find how often it is contained in it, after which there is commonly some remainder; then take this remainder in the compasses, and in like manner find how often it is contained in the last of the integral parts of the first arc, which will again most likely give some remainder; find in like manner how often this last remainder is contained in the former; and so on continually, till the remainder becomes too small to be taken and applied as a measure. By this means M. De Lagny obtained a series of quotients, or fractional parts one of another, which being properly reduced into one fraction, give the ratio of the first arc to that of a semicircle; or the ratio of the proposed angle to two right angles or 180 degrees, and consequently the degrees and minutes of the angle itself becomes known.

Fig. 4.



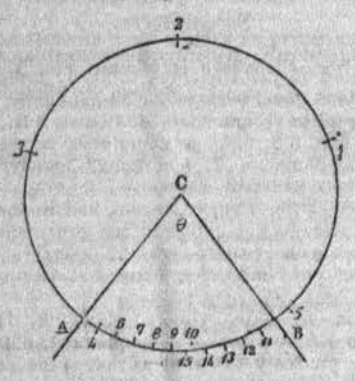
Suppose the angle A C B (fig. 4) be proposed to be measured. Produce A C towards D; and from the centre C, describe the semicircle A B D, on which A B is the measure of the proposed angle. Take A B in the com-

passes, and apply it three times on the semicircle, at 1, 2, and 3; then take the remainder D, 3, and apply it back upon 3, 2, which is but once, namely, at 4; again, take the remainder 4, 2, and apply it three times on 4, 3, at 5, 6, and 7; then take 3, 7, and apply it twice on 7, 6, at 8, and 9; lastly, take the remainder 9, 6, and it will be found to be contained just five times, in 8, 9. Hence the series of quotients in this particular example is 3, 1, 3, 2, 5, which give the continued fraction,

$$\frac{1}{3}+\frac{1}{1}+\frac{1}{3}+\frac{1}{2}+\frac{1}{5},$$ which, when properly reduced, gives vulgar fraction $\frac{49}{185}$, and $\frac{49}{185}$ of $180^\circ = 47^\circ\ 44'$ nearly.

To those acquainted with the doctrine of continued fractions this method of De Lagny is easy enough, and very accurate considering the means employed. If great accuracy be not required, our method may be much contracted, by only applying the arc once round the circle, and then using $\triangle_1$ to find all the other required numbers. Taking the same angle as the one

Fig. 5.



measured in example 3, apply A B (fig. 5), from B to 1; from 1 to 2; from 2 to 3; from 3 to 4; from 4 to 5. Then take B, 5, in the compasses, and apply it from B to 11; from 11 to 12; from 12 to 13; from 13 to 14; and from 14 to 15, near the middle of the arc A B. With the same opening B, 5, or A, 4, or $\triangle_1$, as we have termed it, lay off, 4, 6; 6, 7; 7, 8; 8, 9; and 9, 10. Then the arc between the points 15 and 10 is found to be contained 33 times in the arc A B; but before it was contained 29 times, for 29 $\triangle_2$ was found equal to θ. But by this latter contracted process we find that 33 $\triangle_2$ is equal θ. Our object is to show that this discrepancy will not alter in any great amount the result or measure of the angle in degrees, minutes, &c. From (Q) we have

$$\theta = \frac{n\,q\,\pi}{m\,n\,q \pm q \pm p} = \frac{10\times 33\times 360}{5\times 10\times 33-33+1} = 73^\circ\ 25'\ \tfrac{356}{809}.$$

This result was $73^\circ\ 25'\ \frac{5}{10}$. when q was 29.

To obtain the divisor of (Q), the three numbers m, n, q, have to be multiplied together; to their product q is to added if m be too small, but subtracted if too great; to this sum or difference we must add one if n be too great, but subtract two if n be too small. In the latter case, (Q) becomes

$\frac{10\times 33\times 360}{5\times 10\times 33-33-2} = 73^\circ\ 33'$ nearly, a result which differs from the former results only by 6 or 7 minutes. This circumstance points out the great value of the rule, for it is evident that the result remains nearly the same, whatever be the positions of the points between A and B. Or in other words, the carelessness of the operator does not much affect the result, for in all cases it comes nearly right. I must digress, and add,—what a pity that our statesmen, architects, engineers, &c., cannot discover a few rules of this kind.

A new Life boat was recently tried at Cowes, in the presence of several officers in the navy. The boat was built by Messrs. White and Sons, of Cowes; it is 30 feet long, 9 feet beam, has double sides, and air-tight ends. 135 men were placed in her, and she took in all the water that she could gunwale under, and when she righted gave a fifteen-inch side; in fact, it was found impossible to sink her. She sails very fast, stays in thirty-two seconds, and weighs only seventeen hundred weight. She will carry in her lockers a month's provision for fifty men. The novelty is principally in her form.

ON HERALDRY.

A paper "*On Heraldry*," by Mr. Partridge, read at a meeting of the Decorative Society.

Heraldry was explained to be an organization of emblems and devices, which, undoubtedly, must have existed from the earliest establishment of order and civilization among the human race; and various passages containing records of, and allusions to, its symbols were quoted from Biblical history, showing that it was the medium adopted for distinguishing friends from foes, nation from nation, and tribes and families from each other. Mr. Partridge also referred to, and quoted passages in, Homer, Hesiod, and others, describing the shields of their heroes; adding, that the shields of Achilles, Æneas, and Hercules had, in his opinion, been described with poetical license, but, nevertheless, supplied evidence of the custom of ornamenting shields in the richest manner of the arts of that period. He likewise considered as fabulous the descriptions given by the Jewish rabbi of the standards pitched by the Ten Tribes of Israel. Some references to the subject during the Roman era were followed by observations upon the great change made in the institutions of this country by William the Norman; who modelled his court, as far as practicable, after that of Normandy, and who, therefore, introduced the very remarkable officers whose duties were strictly heraldic.—The Great Constable, whose authority in matters of war and chivalry, both in France and England, during the Norman and Plantagenet reigns, was little less than that of the monarch. The Great Marshal was an important dignitary, whose influence was at its zenith at the time of the Conquest; and the office still remains, through all the changes of legislation and government, one of great power and influence. The third office, being, perhaps, the most singular of any adopted by the Conqueror, was that of Champion. Mr. Partridge traced the hereditary descent of the championship from Marmyon, who received his appointment, with the manor of Scrivelsby, from William; and quoted verses from an ancient poem in which the changes in the families of Marmyon, Ludlow, and Dymoke, the present champion, are set forth. He then referred to Camden, Guillim, Sir Henry Spelman, and other eminent authorities, showing that although many of our noble families can prove their descent from before the time of the Crusades, yet their arms or heraldic bearings had not become hereditary. After the crusades it was accounted honourable to display those ensigns which had been borne in the Holy Wars; and hence the descendants treasured them as their hereditary arms, and the opinion of Lord Chief Justice Coke was quoted showing that he considered this as one of the strongest proofs of a noble and worthy origin.

Mr. Partridge then recited the Roll of Carlaverock—a record in old Norman-French of the names and arms of the leaders who served under King Edward I. at the siege of Carlaverock Castle, Scotland, in 1300; and explained that at that time heraldry was embodied as a science as nearly as possible to its form at the present day. Tournaments were alluded to as an important means in sustaining the dignified bearing and accurate transmission of armorial bearings down to the time of Elizabeth, —when the establishment of the College of Heraldry and the visitations made under its direction created a broad distinctive line between the ancient families and those who have risen to greatness by the increase of civilization and wealth since that period.

Mr. Partridge next drew attention to those arms and mottos which from their relation to names have been ordinarily considered and termed "punning arms,"—but which he said had been practised in remote antiquity, when names had a symbolical source and meaning. He mentioned several names derived from important official duties, such as Usher, Butler, Stewart, &c., in which cases the previous family-name had been disused,—as also that of Godolphin, in accordance with the signification of which a white eagle is adopted as the crest by that family: and this was followed by notices of others of a similar nature.

The lecturer then proceeded to show that the great poets of modern Europe have fully appreciated the value of heraldic distinctions; and said that in the descriptions of their heroes they are usually as heraldically correct as they are poetically beautiful. He referred to and quoted parts from Tasso's "Jerusalem," Shakspeare's "Wars of the Roses," &c. Important allusions in many family mottos, &c., were illustrated: and then he brought the subject to a general summary by maintaining that the detractors of heraldic science are bound to admit one of these two things,—either to prove that all the honours and distinctions which the sovereign of this or any other European state can bestow on eminent men are utter trash, or else to admit that heraldry is one of the important institutions of civilised Europe, as being the recognised medium by which the sovereign —the fountain of honour—bestows that honour on men who have deserved well of their country. This part of the paper was concluded by remarks upon the shield of Baron Napier, and the heraldic honours which he quarters by his descent from Scott of Thirlestane, who received them from King James for his services at the battle of Falkirk in 1298; and the verses by Sir Walter Scott were recited as affording the most eloquent and perfect illustration. Heraldry, he observed, would be found intimately blended with the general history of the middle ages—with the biography of eminent persons and families—with manners and customs—with poetry and polite literature;—and, moreover, it affords a key capable of explaining correctly the meaning of many mysterious and important forms prevalent in embellishments during the feudal period. He alluded to several points

of interesting and somewhat romantic research, showing heraldry to be chiefly a symbolical art.

Mr. Partridge then directed attention to those heraldic figures called "supporters"—such as the lion and unicorn of the royal arms; and he subsequently noticed the analogy existing between heraldic and natural forms. Supporters, it was said, came into use when tournaments and feudal chivalry assumed a scale of splendour requiring a system of distinctions; and it became a practice for the nobles and knights each to hang his helmet and shield, richly emblazoned with heraldic insignia, on the front of his tent when in the field. Two attendants or esquires, dressed in armour, or in a fanciful costume imitative of certain characteristic animated beings, were placed to guard or support them, and also to receive challenges when they arrived. Under such circumstances, it was argued, it is absurd to represent supporters as lying down, walking away, or half asleep, while the heraldic attitude *rampant* should be invariably maintained. Mr. Partridge observed that frequent instances may be seen in St. James's Street and Pall-Mall, and even in the *Gazette* and the *Times*, in which the supporters of the royal arms are represented as crawling in mean-spirited positions, instead of "*rampant, guardant, &c.*"—as set forth in the blazonry. Mr. Partridge remarked that he had not been able to detect an abuse of this kind occurring before about the commencement of the present century; and the supporters were never found in any other position than rampant either in architectural remains or in old works on heraldry. He attributed this infraction in a considerable degree to a volume of Peers' Arms, with supporters, by Mr. Catton, R.A.; who, being a skilful painter of animals, but quite ignorant of the science of heraldry (many of the arms, it was said, are incorrectly given), gave the supporters every variety of attitude, so as to contribute to a novel and pleasing pictorial effect. This course was much calculated to mislead many who possessed some knowledge of drawing, but were ignorantly indifferent to the correct heraldic expression and meaning. Mr. Partridge contended that, if one person may change the attitude of supporters for the sake of pictorial effect, another would be equally justified in changing colours, or in making still greater deviations. Heraldry, he asserted, mainly consists of imitations of natural forms, but which are nearly always made amenable to symbolic and conventional treatment. In cases such as a stag, horse, or eagle "proper," nature may be in many respects faithfully copied from natural bodies; but it will be found that each of these is frequently placed with a symbolic form, such as a dragon, which must be depicted according to the regulations of heraldry. Instances in illustration of these views were offered. The Duke of Devonshire has for supporters "two stags proper," in which case colour and form must be true to nature, but the attitude remains heraldic. The Duke of Northumberland has one gold and one blue lion—which, if painted green, belong to the Earl of Roseberry, or if red, to the Duke of Bedford. Several similar cases were cited. A regard to proportion or relative size of the objects, the lecturer observed, would also tend to produce absurdities; and this went far to prove that they were never intended as pictures for natural history, but as symbolical distinctions treasured by their possessors from feelings of high honour. Examples were adduced of beings of unequal sizes which are often brought together side by side in arms—as a falcon and an elephant—a lion and a cock, for supporters; and similar ones were given applying to crests, quarterings, &c. It was explained that supporters are attached to all arms of peers; and that, with a few exceptions, they do not pertain to those of commoners.

Mr. Partridge then noticed the opinion sometimes held that the extravagant forms of animals used in architectural decoration, as well as in heraldry, are the efforts during a barbarous period, when the people employed could do no better—and therefore ought not to be followed in the present advanced state of manipulative skill. But he argued that this is an erroneous view; and that the human figure and animals were depicted with great fidelity *together with no small show of symbolic art* upon ancient embroidered vestments, stained glass, and in illuminated missals. He considered that the apparent eccentricity proceeded partly from causes not unfelt at the present day; and that many forms were devised to be repulsive of evil spirits and demoniacal influences. The form and size of shields and some other features in heraldry were pointed out for the purpose of illustrating its importance historically,—referring to Winchester School, Eton College, and other buildings—as well as to stained glass windows at Chenies, Bolsover, and St. George's Chapel, Windsor. As an example of family history executed in the present century, a view of the Duke of Bedford's Dining-room was exhibited; in which Mr. Partridge decorated the panelling with shields bearing arms descriptive of all the marriages in the Russell family. He also mentioned that he had been employed by Mr. Macready to emblazon correctly the arms of each personage in Shakspeare's play of "King John."

The paper concluded with some suggestions for the appropriate introduction of heraldic ornament:—and it was stated that before now a shield bearing the proper arms placed on the frame to a portrait had formed an important link in establishing a complete chain of legal evidence.

NEW ARMAMENT FOR THE ROYAL NAVY.

Report of the New Armament which the Board of Admiralty has ordered to be prepared for the Ships of War of all classes in the Royal Navy. The Return includes the new Complements of Men ordered for each class of Ships, and directs the manner in which the Guns are to be Mounted:

First-Rates.

120 Guns.—Britannia, Caledonia, Howe, Nelson, Neptune, Royal Albert, Royal George, Royal William, St. George, St. Vincent, Trafalgar, and Waterloo; total 12; complement, 1,000 men; lower deck, four 8-inch guns of 65 cwt., 9 feet; twenty-eight 32-pounder guns of 65 cwt., 9 feet 6 inches; middle deck, two 8-inch guns of 65 cwt., 9 feet; thirty-two 32-pounders of 50 cwt., 9 feet; main deck, thirty-four 32-pounders of 42 cwt., 8 feet; quarter deck and forecastle, six 32-pounders of 45 cwt., 8 feet 6 inches; fourteen 32-pounder carronades* of 17 cwt.; total, 120 guns.†

110 Guns.—Marlborough, Prince of Wales, Queen, Royal Frederick, Royal Sovereign, Victoria, and Windsor Castle; total, 7; complement, 950 men; lower deck, six 8-inch guns, twenty four 32-pounders; middle deck, four 8-inch guns, twenty-six 32-pounders; main deck, thirty 32-pounders (3); quarter deck and forecastle, six 32-pounders (2); and fourteen 32-pounders of 25 cwt. 6 feet.

Total number of first-rates 19, mounting 2,210 guns.

Second-Rates.

104 Guns.—Camperdown, Hibernia, Impregnable, Princess Charlotte, Queen Charlotte, and Royal Adelaide; total, 6; complement, 850 men; lower deck, four 8-inch guns, twenty-four 32-pounders; middle deck, two 8-inch guns, twenty-eight 32-pounders of 48 cwt. 8 ft.; main deck, thirty 32-pounders of 32 cwt. 6 ft. 6 in., on compressor carriages; quarter deck and forecastle, six 32-pounders (2), and ten 32-pounder carronades of 17 cwt.

92 Guns.—London, Nile, Prince Regent, and Rodney; total, 4; complement, 820 men; lower deck, eighteen 8-inch guns, fourteen 32-pounders; main deck, six 8-inch guns, twenty-eight 32-pounders; quarter deck and forecastle, two 8-inch guns of 52 cwt. 8 feet, and twenty-four 32-pounders (3).

90 Guns.—Albion, Aboukir, Algiers, Exmouth, Hannibal, Princess Royal, and St. Jean d'Acre; total, 7; complement, 820 men. The armament of this class is precisely the same as that of the preceding, with the exception of there being only twenty-six 32-pounders on the main deck, instead of twenty-eight.

84 Guns.—Agamemnon, Asia, Bombay, Calcutta, Canopus, Clarence, Cressy, Formidable, Ganges, Monarch, Powerful, Sans Pareil, Thunderer, and Vengeance; total, 14; complement, 750 men; lower deck, six 8-inch guns, twenty-four 32-pounders; main deck, two 8-inch guns, thirty 32-pounders of 48 cwt. 8 feet; quarter deck and forecastle, six 32-pounders (3), and sixteen 32-pounder carronades of 17 cwt.

80 Guns.—Brunswick, Centurion, Collingwood, Colossus, Goliath, Irresistible, Lion, Majestic, Mars, Meeanee, Superb, and Vanguard; total, 12; complement, 720 men; lower deck, eight 8-inch guns, twenty 32-pounders; main deck, four 8-inch guns, twenty-four 32-pounders (1); quarter deck and forecastle, twenty-four 32-pounder guns (3).

Total number of second rates, 43, mounting 3,758 guns.

Third Rates.

78 Guns.—Achille, Bellerophon, Cambridge, Foudroyant, Hindostan, Indus, Kent, and Revenge; total, 8; complement, 650 men; lower deck, four 8-inch guns, twenty-six 32-pounders; main deck, two 8-inch guns, thirty 32-pounders (2); quarter deck and forecastle, six 32-pounders (3), ten 32-pounder carronades.

72 Guns.—Agincourt, Armada, Belleisle, Black Prince, Carnatic, Cornwallis, Egmont, Hastings, Hawke, Hercules, Illustrious, Implacable, Invincible, Malabar, Medway, Melville, Pembroke, Pitt, Russell, Sultan, Wellesley, and Wellington; total, 22; complement, 600 men; lower deck, four 8-inch guns, twenty four 32-pounders; main deck, twenty-eight 32-pounders (3); quarter deck and forecastle, four 32-pounders (3) and twelve 32-pounder carronades.

70 Guns.—Boscawen, Cumberland; total, 2; complement, 600 men; lower deck, four 8-inch guns, twenty-two 32-pounders; main deck, two 8-inch guns, twenty-six 32-pounders (1); quarter deck and forecastle, sixteen 32-pounders (3).

Total number of third-rates, 32, mounting 2,348 guns.

Fourth-Rates.

56 Guns.—Ajax, Blenheim, Edinburgh, and La Hogue; total, 4; complement, 500 men; lower deck, twenty-six 42-pounders, of 66 cwt., 9 feet 6 inches; main deck, twenty-two 32-pounders (3); quarter deck and forecastle, four 56-pounders, of 87 cwt., 10 feet, and four 10-inch guns, of 86 cwt., 9 feet 4 inches.

50 Guns.—Alfred, America, Arethusa, Benbow, Conquestador, Con-

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* All the carronades are to be mounted on Sir Thos. Hardy's compressor carriages.

† As the weight and length of the guns will always be regulated with strict uniformity, it will be unnecessary to repeat these items in each class. As, however, there are several classes of thirty-two-pounder guns to be used in the navy the figure (1) annexed will show the gun to be one of 50 cwt. 9 feet; (2), one of 45 cwt. 8 ft. 6 inch.; and (3), one of 42 cwt. 8 feet. Where this rule is departed from, the exact length and weight are given. The 32-pounder without any such distinguishing mark is that of 56 cwt. 9 ft. 6 in.

stance, Cornwall, Devonshire, Dublin, Eagle, Gloucester, Grampus, Indefatigable, Leander, Liffey, Nankin, Octavia, Phaeton, Raleigh, Severn, Shannon, Sutlej, Vernon, Vindictive, and Warspite; total, 25; complement, 500 men; main deck, six 8-inch guns; twenty-two 32-pounders; quarter deck and forecastle, four 8-inch guns and eighteen 32-pounders (2).

50 Guns (second class).—Chichester, Java, Lancaster, Portland, President, Southampton, Winchester, and Worcester; total, 8; complement, 450 men; main deck, four 8-inch guns, twenty-six 32-pounders, of 50 cwt., 8 feet; quarter deck and forecastle, four 32-pounders (2), and sixteen 32-pounders, of 26 cwt., 6 feet.

46 Guns.—Arrogant; total, 1; complement, 450 men; main deck, six-8 inch guns, twenty-two 32-pounders; quarter deck and forecastle, two 68-pounders, of 95 cwt., 10 feet, and sixteen 32-pounders, of 32 cwt., 6 feet 6 inches.

Total number of fourth-rates, 38, mounting 1,920 guns.

Fifth-Rates.

40 Guns.—Active, Cambrian, Chesapeake, Flora, Pique, Sybille, and Thetis; total, 7; complement, 350 men; main deck, six 8-inch guns of 60 cwt., 8 feet 10 inches, eighteen 32-pounders; quarter deck and forecastle, sixteen 32-pounders (3).

44 Guns.—Africaine, Andromeda, Druid, Endymion, Hotspur, Isis, Leda, Madagascar, Meander, Nemesis, and Stag; total, 11; complement, 320 men; main deck, two 8-inch guns of 60 cwt., 8 feet 10 inches, twenty-six 32-pounders of 40 cwt., 7 feet 6 inches; quarter deck and forecastle, four 32-pounder guns (2), and twelve 32-pounder carronades. Note.—Endymion is to carry twenty-four 32-pounders of 40 cwt. on main deck, and fourteen 32-pounder carronades on her quarter deck and forecastle.

42 Guns.—Æolus, Blonde, Boadicea, Cerberus, Circe, Clyde, Diana, Fisgard, Fox, Hamadryad, Latona, Laurel, Leonidas, Melampus, Mercury, Mermaid, Minerva, Naiad, Proserpine, Resistance, Seringapatam, Sirius, Thalia, Thisbe, Undaunted, Unicorn, Venus; total, 27; complement, 310 men; main deck, two 8-inch guns of 52 cwt., 8 feet, twenty-two 32-pounders of 39 cwt., 7 feet 6 inches; quarter deck and forecastle, four 32-pounders (2), four 32-pounders of 39 cwt., 7 feet 6 inches, and ten 32-pounder carronades.

36 Guns.—Castor and Inconstant; total, 2; complement, 330 men; main deck, four 8-inch guns of 60 cwt., 8 feet 10 inches, eighteen 32 pounders; quarter deck and forecastle, two 32-pounders (1), and twelve 32-pounders of 25 cwt., 6 feet.

30 Guns.—Amphion; total, 1; complement, 330 men; main deck, six 8-inch guns, fourteen 32-pounders; quarter deck and forecastle, two 68-pounders of 95 cwt., 10 feet, eight 32-pounders of 25 cwt., 6 feet.

24 Guns.—Eurotas, Forth, Horatio, and Seahorse; total, 4; complement, 320 men; main deck, twenty 42-pounders of 66 cwt., 9 feet 6 inches, on common carriages; quarter deck and forecastle, two 56-pounders of 85 cwt., 10 feet, on pivot slides and carriages, and two 10-inch guns of 86 cwt., 9 feet 4 inches, on slides and carriages.

Total number of fifth-rates, 52; mounting 2,096 guns.

Sixth-Rates.

Class I. 26 Guns.—Alarm, Amethyst, Carysfort, Cleopatra, Creole, Diamond, Eurydice, Iris, Juno, Malacca, Niobe, Spartan, and Vestal; total, 13; complement, 240 men; main deck, two 8 inch guns of 52 cwt., 8 feet, sixteen 32-pounders of 40 cwt., 7 feet 6 inches; quarter deck and forecastle, two 32-pounders (3), and six 32-pounders of 25 cwt., 6 feet.

24 Guns.—Amphitrite and Trincomalee; total, 2; complement, 240 men; main deck, eight 32-pounders, ten 8-inch guns; quarter deck and forecastle, four 32-pounders of 25 cwt., 6 feet, and two 56-pounders of 85 cwt., 10 feet.

26 Guns.—Amazon; total, 1; complement, 240 men; main deck, twenty-six 32-pounders (1).

24 Guns.—Aigle and Curaçoa; total, 2; complement, 230 men; main deck, twenty 32-pounders of 40 cwt., 7 feet 6 inches; two 32-pounders (1); quarter deck and forecastle, two 8-inch guns of 52 cwt., 8 feet.

20 Guns.—Brilliant; total, 1; complement, 230 men; main deck, ten 32-pounders (1); six 8-inch guns of 52 cwt., 8 feet; quarter deck and forecastle, two 56-pounders of 85 cwt., 10 feet, and two 32-pounders of 25 cwt., 6 feet.

19 Guns.—Havannah; total, 1; complement, 230 men; main deck, ten 32-pounders (1), six 8-inch guns, of 52 cwt., 8 feet; quarter deck and forecastle, one 56-pounder, of 85 cwt., 10 feet, and two 32-pounders (1).

19 Guns.—Dædalus; total, 1; complement, 230 men; main deck, twelve 32-pounders (1), six 8-inch guns, of 52 cwt., 8 feet; quarter deck and forecastle, one 56-pounder, of 85 cwt., 10 feet.

Class II. 26 Guns.—Actæon, Andromache, Calliope, and Conway; total, 4; complement, 195 men; main deck, two 8-inch guns, of 36 cwt., 5 feet 4 inches, sixteen 32-pounders, of 25 cwt., 6 feet; quarter deck and forecastle, two 32-pounders (2), and six 32-pounder carronades.

18 Guns.—Calypso and Coquette; total, 2; complement, 195 men; main deck, two 8-inch guns, of 52 cwt., 8 feet, fourteen 32-pounders, of 40 cwt., 7 feet 6 inches; quarter deck and forecastle, two 32-pounders (2), on slides and carriages, to pivot.

18 Guns.—Daphne, and Dido; total, 2; complement, 175 men; main deck, two 8-inch guns, of 52 cwt., 8 feet, fourteen 32-pounders (3); quarter deck and forecastle, two 32-pounders (3).

22 Guns.—Herald, North Star, Samarang, Talbot, Tyne, and Volage; total, 6; complement, 175 men; main deck, two 32-pounders, of 39 cwt., 7 feet 6 inches, sixteen 32-pounder carronades; quarter deck and forecastle, four 32-pounder carronades.

Total number of sixth-rates, 35, mounting 826 guns.

Sloops.

18 Guns.—Arachne, Modeste, Narcissus, Nimrod, Pearl, Tweed, and Terpsichore; total, 7; complement, 145 men; two 32-pounders of 39 cwt., 7 feet 6 inches, and sixteen 32-pounders of 25 cwt., 6 feet, all on slides and carriages.

16 Guns.—Atalanta, Camilla, Frolic, Helena, Siren, and Zebra; total, 6; complement, 130 men; the armament of this class is precisely the same as the last, with the exception of there being only fourteen 32-pounders instead of sixteen.

14 Guns.—Champion, Comus, Electra, Favourite, Hazard, Hyacinth, Larne, Orestes, Racehorse, Rose, Satellite, Scout, and Wolf; total, 13; complement, 130 men; armament similar to that of the first class, but the number of 32-pounders reduced to twelve.

12 Guns.—Acorn, Albatross, Arab, Bittern, Columbine, Contest, Daring, Dispatch, Elk, Espiègle, Fantôme, Flying Fish, Goshawk, Grecian, Heron, Kangaroo, Kingfisher, Mariner, Martin, Mutine, Persian, Pilot, and Recruit; total, 23; complement, 130 men; armament the same as the first class, but the number of 32-pounders reduced to ten.

12 Guns.—Childers, Cruizer, Harlequin, Liberty, Lily, Pelican, Racer, Ringdove, Sappho, Serpent, Snake, Sparrowhawk, Squirrel, Wanderer, Wasp, and Wolverene; total, 16; complement, 130 men; two 32-pounders of 32 cwt., 6 feet 6 inches, and ten 32-pounders of 25 cwt., 6 feet.

8 Guns.—Cygnet, Ferret, Heroine, Hound, and Philomel; total, 5; complement, 80 men; armament as in the last class, but the number of 32-pounders reduced to six.

8 Guns.—Alert, Linnet, Ranger, and Star; total, 4; complement, 80 men; two 32-pounders of 32 cwt., 6 feet 6 inches, and six 32-pounder carronades.

8 Guns.—Britomart, Pantaloon, Rapid, Sealark, and Waterwitch; total, 5; complement, 80 men; two 18-pounders of 20 cwt., 6 feet, and six 18-pounders of 15 cwt., 5 feet 6 inches.

Total number of sloops, 79, mounting 984 guns.

Brigs.

6 Guns.—Camelion, Curlew, Espoir, Nautilus, Rolla, Royalist, Saracen, Savage, Scorpion, and Wizard; total, 10; complement, 65 men; two 32-pounders of 32 cwt., 6 feet 6 inches; and four 18-pounder carronades of 10 cwt.

3 Guns.—Bonetta, Dart, Dolphin, and Spy; total, 4; complement, 65 men; one 32-pounder of 39 cwt., 7 feet 6 inches, and two 32-pounders of 32 cwt., 6 feet 6 inches.

3 Guns.—Griffin, and Lynx; total, 2; complement, 60 men; one 32-pounder of 39 cwt., 7 feet 6 inches, and two 24-pounder carronades of 13 cwt.

Total number of brigs, 16, mounting 78 guns.

Summary.

			Guns.	Men.
19	first-rates, mounting	....	2,210	18,650
43	second-rates	,, ...	3,758	33,260
32	third-rates	,, ...	2,348	19 600
38	fourth-rates	,, ...	1.920	18,550
52	fifth-rates	,, ...	2,096	16,610
35	sixth-rates	,, ...	826	7,470
79	sloops	,, ...	984	9,675
16	brigs	,, ...	78	1,030
Grand total, 314 ships of war		,,	14,220	124,845

Steam Vessels Propelled by Screws.

The return published in the *Journal* for May last, of the armament of the screw steam vessels remains unaltered under the present return, the only difference being that the name of the Pegasus is now altered to that of the Greenock. The complement of men has, however, since been fixed, as follows:—Simoon and Vulcan, 300 men; Termagant, Dauntless, Euphrates, and Vigilant, 250 men; Megæra and Greenock, 200 men; Conflict, Basilisk, Desperate, Enchantress, Falcon, Florentia, Niger, Encounter, and Harrier, 140 men; Rattler and Phœnix, 120 men; Archer, Cossack, Parthian, Rifleman, Sepoy, and Sharpshooter, 80 men; Biter, Boxer, Minx, and Teazer, 30 men.

The steam frigates with auxiliary power, and the steam guard ships, have been taken out of the catalogue of the steam navy, and placed with the sailing vessels.

Steam Vessels Propelled by Paddles.

Some slight alterations have been made in the classification of the steam-vessels propelled by paddles; but the armament being for each class substantially the same as given before, the following arrangements of the vessels, and their complements is all that it will be necessary to give: Terrible, 16 guns, 300 men; Penelope, 16 guns, 270 men; Odin, Leopard, and Sidon, 12 guns, 270 men; Avenger, Birkenhead, and Retribution, 6 guns, 250 men; Centaur, Cyclops, Dragon, Firebrand, Gladiator, Sampson, and Vulture, 6 guns, 195 men; Scourge, 2 guns, 160 men; Bulldog, Cormorant, Devastation, Driver, Eclair, Fury, Geyser, Gorgon, Growler, Inflexible,

Sphynx, Spiteful, Styx, Stromboli, Thunderbolt, Vesuvius, Virago, and Vixen, 6 guns, 160 men; Hecate, Hecla, Hermes, Hydra, Medea, Salamander, and Trident, 6 guns, 135 men; Ardent, Alecto, Polyphemus, and Prometheus, 3 guns, 100 men; Janus, 2 guns, 100 men; Acheron, Antelope, Columbia, Grappler, Oberon, Pluto, Triton, and Volcano, 3 guns, 60 men; Blazer, Firefly, Flamer, and Tartarus, 3 guns, 55 men; Avon, Cornet, Gleaner, Kite, Lucifer, Lightning, Meteor, Porcupine, and Shearwater, 3 guns, 40 men; Alban, Dee, and Rhadamanthus, 4 guns, 60 men.

ENGINEERING EVIDENCE.

Extracts from Unpublished Evidence given by MR. R. STEPHENSON *before the House of Commons' Stour Valley Committee.* [Reported in the *Railway Chronicle*]

ON SPEED—COMPETITION—THE FOUR-RAIL SYSTEM—THE TRUE PRINCIPLES OF GOODS AND COAL TRAFFIC, &c.

The Four-rail System—Economy.—In consequence of our fixed establishment we shall be able to carry the additional traffic we obtain cheaper than any other company can do. At present, as you converge towards London, the trains become more numerous, and when any of them are not in time they give rise to great disorder; not because the railway is incapable of carrying them when they keep their time regularly—for the London and Birmingham are capable of accommodating three times the amount of their present traffic, provided absolute punctuality is insured. More towards London the value of punctuality begins to tell most, and we want more lines. A loop line from Tring to Banbury [the Buckinghamshire, since passed] would accommodate local traffic, and could also be made subservient to heavy traffic moving at slow rates. Four lines of rails from London to Tring would receive and divide the great tide of traffic flowing toward the metropolis (at present flowing on two lines of rail only), and by enabling us to serve the public better attract more traffic to us.

Competition.—Looking at the past, we may expect for some time to come that the hostile companies will go on devouring each other, though I hold the opinion very strongly that permanent competition is impossible. The object of companies who are in competition in laying out lines is generally for the purpose of maintaining the ground, in order that when the time does arrive for adjusting their differences they may not be trampled on by their neighbours. I have the strongest possible opinion that perpetual competition is impossible, and that after the country is occupied there will be an adjustment. The Great Western are great preachers of competition, yet it is within my own knowledge that treaties have been going on between them and the London and South-Western, of which a territorial division has been the basis.

Quick and Slow Traffic (London and North-Western).—At present we are obliged to force on our goods trains to make room for our passenger trains. The cost of conveying goods is augmented in consequence of that speed. The public will never get the full advantage of railways until they can separate the slow traffic more or less from the quick traffic. Up to a certain extent the mixture does not add to the expense of conveyance, but when the mixture becomes very great, or the income of the railway is derived as much from goods as from passengers, then, in order to convey goods most economically, it becomes desirable to convey them at a speed of, say, from 15 to 18 miles an hour, coals at a speed not exceeding 15 miles an hour, for it is impossible to convey them at 1*d.* or ½*d.* per ton per mile if they are to be hurried along at 25 or 30 miles an hour; the cost and the wear and tear are too great, besides coal is damaged very much by velocity. The clogging of the London and Birmingham line referred to has arisen from the tolls having been very much lowered. Many persons thought that the reduction of tolls would not increase our traffic. Now, I held a different opinion. I always thought that by reducing fares on railways, especially the charges on goods, they would become great instruments of conveyance for the heavy class of articles: and so it turned out. So that a great increase came upon us suddenly, without our having either wagons or engines adequate for the increase.

Wear and Tear on Broad and Narrow Gauge.—*Q.* Is there no difference of pressure on the same weight of engine at the same speed on the broad and narrow gauge?—*A.* None; the crushing effect is precisely the same, or rather the crushing effect of the wide gauge is greater at the curves than on the narrow gauge. If there was any difference in the tendency of the heavy weights to crush the rails, it would tell against the wide gauge at curves, because the wheels are keyed on the axle, and they consequently move round with the same velocity, and when the engine is going round a sharp curve there is a greater distance to go round upon the outside, so the inside wheel has to slide a little back and the outside wheel has to slide a little forward; and, inasmuch as the difference of gauge increases the amount of sliding, the heavy weights will crush the rails more in the one case than in the other, but in a perfectly straight line the crushing is equal.—*Q.* Is the rail stronger on the broad or the narrow?—*A.* The rails are laid by Mr. Brunel on longitudinal timbers. He takes the strength of the timber as well as the iron. In the usual mode of constructing the narrow gauge you do not use the longitudinal timber, but you lay heavier rails instead. You get the bearing strength entirely on the rails in the one case, and in the other case partly on the timber.

Speed.—We are now in possession of speed that no permanent way in existence, broad or narrow, will be able to stand long. The wear and tear of the rails has been, in my opinion, nearly as the square of the speed. If it were perfect machinery in every respect, the wear and tear arising from concussions, ought to be exactly as the square of the speed, and I presume it ought to be directly as an engine weighing double the number of tons would cause double the amount of crushing. Indeed, I know that speed is the great trial of our present permanent roads. The proof is that we have been obliged to strengthen them about 16 or 18 lb. per yard, and now there are some of about 90 lb. This increase of speed, the weight remaining the same, is a direct and large sacrifice of the profits of the company, which has operated and is now operating with the London and Birmingham, and has led them to consider the propriety of duplicating the lines where they are compelled to run the heavy trains so quickly—that is between Tring and London. The interest of the capital they are about to expend to duplicate the line will be about 40,000*l.* a-year, the cost will be about 780,000*l.*

The origin of the Oxford, Worcester, and Wolverhampton.—*Q.* Is it a fact that this district applied to the London and Birmingham for accommodation and was refused, and was it in consequence of that refusal that the Oxford, Worcester, and Wolverhampton line was originally projected?—*A.* That, perhaps, is a rather harsh mode of representing it. But some of the London and Birmingham Board entertained a notion at that time that railways were not really fitted for the conveyance of heavy goods, and they did not seek to obtain the traffic which the country demanded; and then again their accounts were kept in such a way as to make it appear that they lost money by the conveyance of goods. This was done by charging the goods with a portion of fixed expenses, which would have been necessary under any circumstances even for conveying passengers. Therefore, when you debit the goods department with its proportion of the fixed establishment of the railway, then it does appear a loss to carry goods. There may be one or two of the Board now left who entertain their old opinions, but I know the management and system has undergone a complete revolution in that respect. I have always entertained the opinion that they ought to come down with their fares and carry heavy goods, and have urged it on the Board. But I do not move out of the engineering department of the company. I think that railways as instruments for the carriage of heavy goods, have not reached half their perfection or extent, and will not until we are permitted to separate the fast and slow trains. If we convey heavy goods at 15 miles an hour, I believe it will reduce the cost of conveyance to considerably lower than one half of what it is now; so that a large quantity of coal may come to London from the Midland districts. At present it costs us three farthings per ton per mile. In the North at Stockton and Darlington, where they convey the coal at 9 miles an hour, every charge is included, and they carry it at one halfpenny per ton per mile. The breakage of coal is so much increased by rapidity of movement, that it becomes impossible to move ordinary coal wagons when they are on any of the main lines without springs. The speed breaks the coal all to pieces. Experience has shown that the multiplication of railroads facilitates and creates much greater traffic than was anticipated. They reach on each other. That is one of the most remarkable features in the extension of the railroad system—the extraordinary reciprocation of traffic. If by the multiplication of railroads, and the adoption of economical modes of transit, you can reduce the price of coal, the demand for the article in London would be most prodigious, and in the country it would be very large. There are many agricultural counties where they do not know what coal is now.

REGISTER OF NEW PATENTS.

AMERICAN PATENTS.

PNEUMATIC HYDRAULIC ENGINE.

Specification of a Patent for "an Improvement in the hydraulic ram, called 'Strode's pneumatic hydraulic engine;'" granted to JOSEPH C. STRODE, *of East Bradford township, Chester county, State of Pennsylvania, March* 27, 1847. [Reported in the *Franklin Journal.*]

The nature of the invention and improvement consists in making use of a column of condensed air between the propelling fluid and the fluid that is to be raised; said air being condensed in a pyramidal-shaped chamber, by means of the momentum of a descending column of water; said chamber having a communication, by a small opening at its top, with another chamber, into which the spring water or fluid to be raised is introduced, called the spring water chamber, and upon which the condensed air in the first-named chamber is made to act, causing said fluid to rise through a tube placed in the spring water chamber (open at its lower end, and closed alternately at its upper end by means of a valve), into a large air vessel, or receiver, of the usual form and construction, being conducted thence to its place of destination by pipes, or hose, in the usual manner.

Similar letters in the several figures refer to corresponding parts.

A is the main pipe for conducting the propelling water from the head, or reservoir, to the pyramidal air chamber. This pipe descends

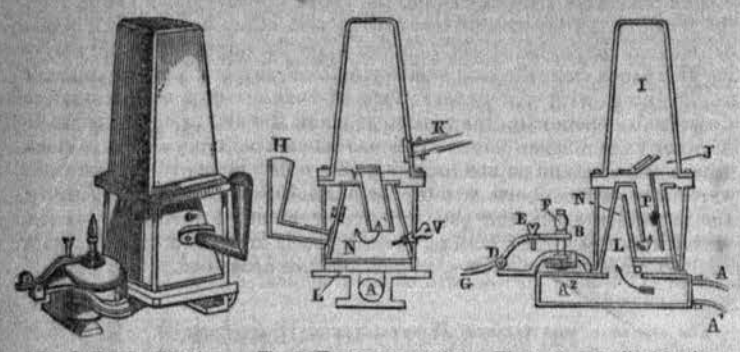


Fig. 3. Perspective view. Fig. 2. Transverse section. Fig. 1. Longitudinal section.

below the level of that portion of it which connects with the air chamber just before it reaches the said chamber, and then ascends, in a curved line to it, forming a curved bend in the pipe, as at A^1, for the purpose of preventing the air received at the valve B, during the time in which the vacuum is produced in the air and water chamber, as hereafter described, from filling the pipe A, as the air will not descend at said bend in the tube, so that the surplus of said air, after having filled the condensing chamber L, may be carried off, by the current of water, through the valve B.

The pipe A is enlarged below the air chamber L, as at A^2, and has an opening O into the air chamber S, through which the water passes when the valve B is closed.

B is a valve attached to a curved, vibrating lever C, turning on gudgeons D, in boxes, as its fulcrum, having a set screw E, for regulating the descent of the valve, and a counter-balance F, for adjusting the valve. When this valve B is down, as shown in fig. 3, the water from the head flows through the opening, which it closes; when it is up, as shown in fig. 1, the water rises into the pyramidal chamber L, through the opening O, and condenses the air therein.

H is a pipe for conveying the spring water to the spring water chamber. I is the air chamber into which the water is forced. J is the valve for holding it. K is a pipe or hose, for conveying the water to its place of destination. The above-named parts, lettered from A to K, inclusive, are made and operated in the usual manner. The improvements are as follows:

L is a pyramidal chamber into which air is admitted through the valve B, when it descends by the pressure of the external air, to supply the partial vacuum created in the pipe A, and chambers L and N.

This pyramidal chamber has a communication, by a small opening M at the top, with another chamber N, called the spring or pure water chamber; through which opening M, the air, so condensed, is forced, and presses on the spring or other water, introduced into the same through the pipe H, by which pressure, the water in the spring water chamber is forced upward through a tube P, reaching to near the bottom of the chamber N, through the valve J, into the air chamber I; said valve being represented as open in fig. 1, and as closed in fig. 2.

To raise water with this machine, open the valve B, and let the water flow out; then, by closing the valve B, the water, which is now in motion in the pipe A, will pass through the opening O, into the pyramidal condensing chamber L, and condense the air the same as before; the condensed air will force the spring water up the tube P, (which had entered through the pipe H during the continuance of the partial vacuum above spoken of), into the chamber I, and condense the air therein, until its density is equal to that in the condensing chambers L, and N, below; at this time the spring water will cease to flow into the air chamber I, the valve J closes, and the air in the chambers I, L, and N, commences expanding, that in the lower chambers, L and N, giving motion to the propelling fluid and driving backward, producing a partial vacuum in the machine, and the air in the upper chamber I, forcing the spring water to its place of destination.

The said partial vacuum in the machine, caused by the reaction of the machine, as aforesaid, and the pressure of the exteral atmosphere on the valve B, will cause it to open again. The water from the head then flows through this valve with an accelerating movement, until it has acquired that degree of velocity as to cause the valve to close. The water having no longer any vent through the valve B, passes through the opening O, into the pyramidal chamber L, and repeats the operation above mentioned successively.

In this manner the operation will continue as long as the machine remains in order and there is a head of water to propel it. The valve V is for the purpose of supplying the chamber I with air, by admitting the air into the tube P. The said air is admitted during the time that the partial vacuum above mentioned takes place. The air thus introduced into the tube P ascends to the top of the same, and is forced into the chamber I at the next stroke of the machine; said valve V is represented open in fig. 2, and may be closed, or regulated, by screwing the thumb-screw V.

The principal advantages this machine possesses over other machines are,

1st. In case of forcing up pure water by the propelling power of a running stream of water less pure, there is no possibility of the impure water mixing with the pure, there being at that time a column of condensed air between the two waters.

2nd. The water being forced into the upper chamber I, by the condensation of air in the lower chamber, the valve J opens more slowly than when water alone is made the propelling medium, and also shuts more slowly, thereby preventing the water from escaping back through the valve J after it is forced up—the valve J being nearly closed when the water ceases to flow upward into the chamber L. This advantage upon trial is found to be of considerable importance, enabling the machine, thus operated, to force, with a given quantity of water, several barrels more of water per day than it would otherwise do.

3rd. There being no valve between the condensed air in the lower chamber and the driving water, or at the opening O, the said air is permitted to act a longer time in forcing back the driving water, and thereby making a more complete vacuum than in other machines, and rendering useless the spring for opening the outlet valve B, as used in several machines.

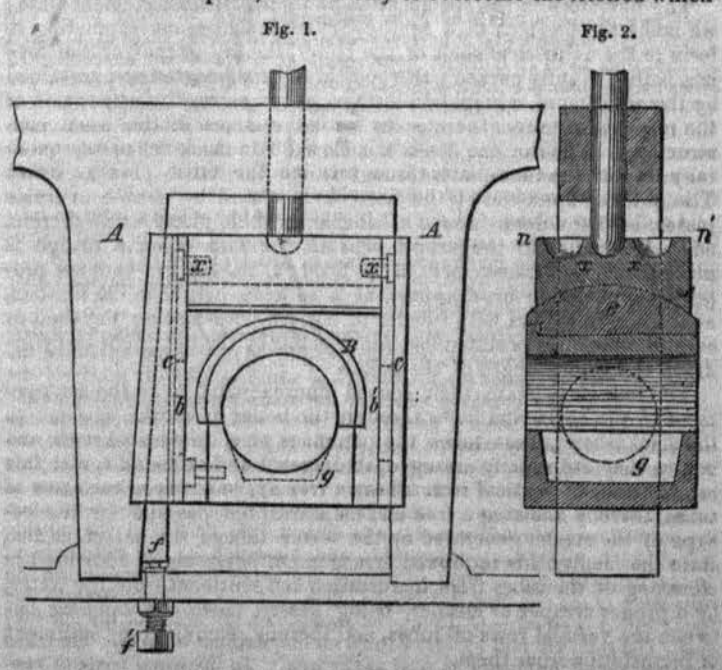
It is not necessary that the spring water chamber N, and the air chamber L, should be enclosed by the same envelope, but they may form separate chambers, and they may be arranged in any convenient way or manner most acceptable to the constructor, provided that the capacity of the air chamber does not exceed a due ratio between the propelling power and the water to be raised.

LOCOMOTIVE AXLE BOX.

Description of "*a vibrating box for locomotive axles*," by Norris and Tull, of Philadelphia, U.S., June, 1846.

The arrangement of this box allows it to revolve in a vertical plane, at the same time that it floats up and down, the journals of the drivers having, at all times, their full bearing upon the box; let the axle assume any position from a horizontal line caused by inequalities of the road, or the consequent raising of the outer rail, in passing curves, which must necessarily reduce friction in a great degree, and insure the more perfect working of the engine, without producing any undue strain in its several parts, and has only to overcome the friction which

Fig. 1. Fig. 2.



is due to the surfaces upon which it works. This evil has always been overlooked in the construction of locomotives, and which must occur when a box floats vertically in a pedestal. Fig. 1, elevation of

pedestal with vibrating box; fig. 2, cross section of the same; fig. 3, horizontal plan; fig. 4, vibrating box; fig. 5, bearing of vibrating box.

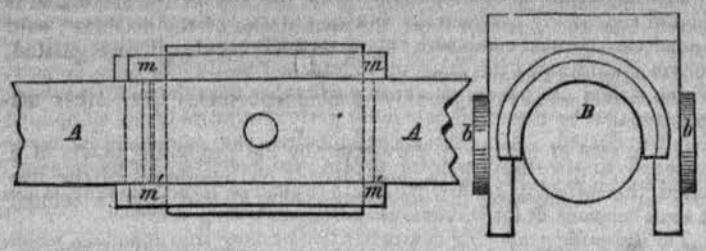
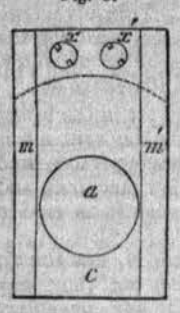


Fig. 3. Fig. 4.

A, A, pedestal forming part of the wrought iron frame. B, vibrating box resting with the two pivots b, b', which are firmly attached to it in openings of the two sliding pieces, c, c'. Fig. 5, shows an end view of one of the latter, with its flanges, m, m', and the hole, a, which is to receive the pivot, b. These sliding-pieces are connected, by means of screws, x, x', with the cross-piece, d, the lower surface of which is cylindrical, and forms a bearing for the upper convex surface, n, n', of the box, B. f, wedge, kept by the set-screw, f', in a position which allows the box to slide in the pedestal, without being too loose or too firm. g, oil-box. In fig. 4, this oil-box is omitted. The same parts are marked by the same letters in the different views.—*Franklin Journal.*

Fig. 5.



ENGLISH PATENTS.

LOCOMOTIVE ENGINES.

GEORGE FOSSICK, engine-builder, THOMAS HACKWORTH, engine-builder, and THOMAS ELLIOTT, superintendent of locomotives, all of Stockton-upon-Tees, for "*certain Improvements in locomotive and other boilers.*"—Granted March 3; Enrolled Sept. 3, 1847. [Reported in the *Patent Journal.*]

The improvements here specified relate, first, to the form or shape of the fire-box of locomotive and other tubular boilers; secondly, to the arrangement of the tubes; thirdly, dividing, in boilers of large diameter, the fire-box into two portions, by means of a vertical division.

The patentees in the specification of their first improvement state: we make the fire-box of a semi-cylindrical shape, corresponding in form to the cylindrical shell of the boiler, the top or roof of the fire-box being slightly curved; this roof is to be supported and sustained by the addition of wrought-iron stays, placed across the upper side of the roof and rivetted thereto; as with fire-boxes of the usual construction, the end of the fire-box is closed by a thick flat plate, generally termed the tube-plate, through which the tubes pass as usual. The outer or open end of the fire-box is closed by double or treble plates, having a door formed of double or treble plates made therein, and an opening to the ashpit beneath the said door; a bridge is placed, as usual, transversely in the fire-box, and the fire-bars are properly supported by bearing-bars, at a suitable height in the fire-box, as is usual in boilers with tubular or enclosed fire-places; the shell or case of the boiler is stated and represented by the patentees as cylindrical the whole length of the boiler.

The patentees state their second improvement to be the arrangement of the horizontal tubes through the boiler from the fire-box to the smoke-box; these tubes the patentees place in vertical rows, and not, as they are usually arranged, in diagonal or horizontal rows; this arrangement of vertical rows allows a free space between each row of tubes, thereby allowing a free and uninterrupted passage for the escape of the steam, generated by the lower tubes: the patentees also state the facility this improved arrangement possesses of allowing the cleansing of the tubes from incrustation and sediment from the water, by a proper scraper or cleaner, being passed down the opening between the vertical rows of tubes, and thereby removing any sediment or incrustation from them.

The patentees state their third improvement to be the employment or introduction of a vertical division of water space, placed within the semi-cylindrical fire-box, and thereby dividing the said fire-box into two separate compartments; this arrangement the patentees propose adopting when boilers of increased diameter are required.

The patentees after describing the above improvements claim, first, the forming the fire-box of locomotive and other boilers of a semi-cylindrical shape, but slightly curved upon the upper side, and carrying the tubes from the said semi-cylindrical fire-box in such manner as agreeing with the general form of such fire-box, as hereinbefore described. Secondly, the patentees claim the arranging the tubes in locomotive and other boilers known as tubular boilers, in vertical rows, whereby a free and uninterrupted passage is obtained between such vertical rows from bottom to top, as hereinbefore described. Thirdly, the patentees claim the use and arrangement of vertical divisions, within the fire-box, of boilers, dividing such fire-boxes into separate compartments or fire-places, as hereinbefore described.

IMPROVEMENTS IN FURNACES.

GEORGE GRUNDY, of Manchester, in the county of Lancaster, manager, for "*certain Improvements in furnaces, and in the flues and tiles used in the construction thereof.*"—Granted February 8; Enrolled Aug. 8, 1847.

This invention relates to a novel arrangement of the flues and other parts of a furnace, whereby the heat is more effectually applied; and also in certain tiles to be used in the construction of the furnace. The annexed engravings show a furnace, constructed according to this invention, containing four fire-clay or tile cylinders or retorts, for generating coal gas.

Fig. 1. Fig. 2.

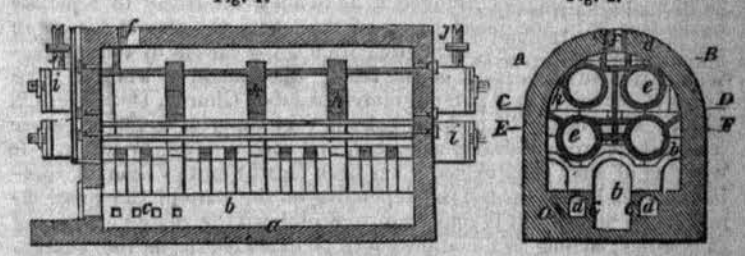


Fig. 5.

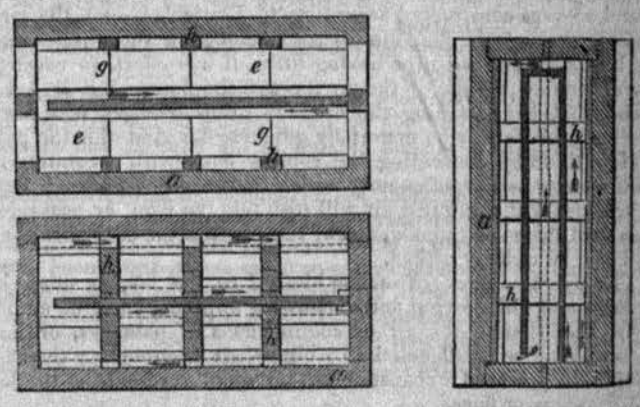


Fig. 4. Fig. 3.

Fig. 1 is a longitudinal vertical section of the furnace; fig. 2 is a transverse vertical section thereof; fig. 3 is a horizontal section, taken on the line A B of fig. 2; fig. 4 is a similar section, on the line C D; and fig. 5 is a section on the line E F. a is the brickwork of the furnace. b is the fire-place or chamber, wherein the fuel (which in this case is coal-tar, but other fuel may be used) is introduced; it extends the whole length of the furnace, and is supplied with air through the openings c, from two parallel flues d, which extend from one end of the furnace to the other, and are furnished with doors at each end to regulate the supply of air. The oven, in which the tile or fire-clay cylinders or retorts e are fixed, is of the ordinary shape; and the course of the flame and heated gases, generated below, is indicated by the arrows in the horizontal sections, figs. 3, 4, 5, which are taken at different levels, in order to show the continuous traverse of the heated gases from end to end, or from end to centre of the retorts e, until they escape through the opening f, in the crown of the oven. The cylinders or retorts are made of tile or fire-clay, and may be strengthened, if considered requisite, by imbedding metal hoops in the clay. Each cylinder is open at both ends, and consists of several pieces, which are jointed together, as seen at g, fig. 5; the joints being made good with fire-clay, and supported by the fire-clay tiles h. The number of joints in each retort will depend upon its

length; but this may greatly exceed the length of ordinary retorts, on account of the facility of working at both ends, which the patentee considers an important feature of his invention. The retorts have caps *i*, fitted on each end, furnished with exit-pipes *j*, for the gas. Any accumulation of coal-tar is removed from the retort, by partially opening one end of the retort, and applying an extra pipe to the opposite end; which pipe then acts as a flue, and the draft of air through the heated retort completely removes the carbonaceous deposit.

The patentee states, that the description of the manner of applying his improvements to a furnace for generating gas will enable a person to apply such improvements to furnaces for other purposes. He claims the general arrangement of the furnace and flues as described, which consists in a continuous fire-place from one end to the other, supplied with air from parallel air-flues—thus allowing the heat to be conducted from end to end, or from end to centre repeatedly; together with the peculiar form and construction of tile or fire-clay tubes, and the tiles forming the joints, as above described.

COOLING COKE OVENS.

Frederick Ransome, of Ipswich, Suffolk, for "*Improvements in working coke and other kilns or ovens.*"—Granted Feb. 24; Enrolled Aug. 24, 1847.

This invention consists of improvements in cooling coke and other kilns or ovens, by causing air to circulate by mechanical apparatus through the cooling flues or passages.

In the working of coke ovens the cooling has been extensively done by having air passages arranged so as to allow air freely to circulate in contact with the inner lining of the oven, the air not coming in contact with the charge, such circulation being caused by the rarefaction of the air by the heat of the flues. Such mode of working coke ovens is according to a patent granted to Jabez Church, December 20, 1845. This mode of making coke is very superior to the old mode where the charge is drawn when hot, and cooled down by water. In working of such coke ovens, it has been found that the time of cooling an oven is very uncertain, depending on the state of the outer atmosphere, and that it is important to cool down the charge as quickly as possible, so long as the atmosphere is excluded from the charge. In coke ovens constructed according to Church's patent, the air after passing through the flues simply rises through a short pipe into the air by its levity, the pipe having little, if any effect, in causing the circulation or passage of the air through the flues. But it has been found that by hastening the draft in ovens arranged with flues, the cooling process may be materially quickened. And this the patentee prefers to do by connecting the cooling flues with a rotatory fan, in such manner as to continuously withdraw the air from such flues, by which means the external air will rush into the flues or passages, and thus cool the same quickly, and by these means the charge in the oven will also be quickly cooled.

The patentee does not confine himself to the fan, as other known arrangements of blowing and exhausting apparatus may be employed, or in place thereof the air or cooling flues or passages, or the pipe thereof, may be conducted into a high shaft or chimney; thus adding additional power of exhaustion to that which results from the heat of the passages or flues.

CAOUTCHOUC.

Stephen Moulton, Esq., of Norfolk-street, Strand, Middlesex, gentleman, for "*Improvements in treating caoutchouc with other materials, to produce elastic and impermeable compounds.*"—Granted Feb. 8; Enrolled Aug. 8, 1847.

This invention consists in treating caoutchouc by combining therewith calcined and carbonate of magnesia and hyposulphate of lead and the artificial sulphuret of lead, and submitting the combined compound to heat, which process dispenses with the use of solvents. After the caoutchouc has been cut and cleansed, one or more pounds weight, as can be conveniently ground or mixed at a time, is put between two revolving iron rollers, heated internally by steam, when it presents a rough, uniform sheet, and is then ready for the mixing it with the following ingredients.

If the goods are intended to be elastic, and to be unaffected by heat or cold, mix in with 1 lb. of caoutchouc, from 1 to 8 oz. of the hyposulphate of lead and the artificial sulphuret of lead, both or either, but the patentee prefers them in equal proportions; but if they are used separately, then the whole quantity mentioned will be used. If the goods are intended to be hard, of greater tenacity, and of less elasticity, mix in from 2 to 8 oz. of the calcined or carbonate of magnesia with 1 lb. of caoutchouc, and then add both the hyposulphate of lead and the artificial sulphuret of lead, or either, in like manner and proportions, as used for elastic goods.

The materials above-mentioned and the caoutchouc having been passed repeatedly between the mixing rollers, so that the whole compound may be well combined, it is then removed to another pair of rollers denominated the grinding rollers, and treated in like manner, which rollers are placed nearer to each other than the mixing rollers, in order that by these rollers a more perfect mixture of the compound may be effected. After this second process, the compound is again removed to the third pair of rollers, also heated by steam, denominated the softening rollers, and again ground or mixed thereby, when it soon becomes fit for its removal to the spreading machine.

The spreading machine comprises two or more iron cylinders, which are heated internally by steam (the machine preferred consists of three rollers one above the other), and of a smoother and finer surface than that of the rollers before-mentioned. The compound is placed between the upper rollers and passes to the lower one, upon which the cloth for its reception passes round, and thus receives on its surface the different coatings of the compound required. If sheet rubber is desired, the compound is placed in like manner, dispensing with the use of the cloth, and the sheet taken from the lower roller. Both the coated cloth and the sheet rubber in passing off the lower roller are rolled up in dry cloth to keep the surfaces apart, and is then fit for making up into such goods as may be required. In manufacturing goods from the compounds thus prepared, when manufactured, they are dusted over with purified pipe or other clay of similar quality finely powdered, to prevent the surfaces from adhering together; but they are as yet still liable to the action of all the solvents and other influences which act upon caoutchouc, and would accordingly become rigid in cold, and soft and sticky in warm weather; to free the caoutchouc therefore from these, its natural characteristics, it has been combined with the salts of lead above-mentioned, and the goods manufactured from this compound have now to be subjected to heat in a suitable chamber or cylinder, and heated either by steam or dry heat (the former is preferred) of from 220° to 280° or 300°, according to the quantity of the goods heated at one time, and also as to the thickness of the compound put into the sheets or upon the cloth.

The time required for heating goods will likewise vary according to the circumstances last mentioned. Some heats may require three hours, and some five hours or thereabouts, and which is easily determined by any practical man acquainted with the business. After the goods have been heated, as last mentioned, they become elastic and impermeable, as set forth in the title above recited.

RAILWAY SWITCHES AND TURN-TABLES.

Charles Heard Wild, of Mortimer-street, Cavendish-square, civil engineer, for "*Improvements in constructing parts of railways,*"—Granted Feb. 24; Enrolled Aug. 24, 1847. [Reported in the *Patent Journal.*]

The improvements here specified relate severally to the form of the points of the moveable tongue rails of railway switches, and to the construction and application of certain mechanism to turn-tables, to facilitate their action. The object of the patentee being to remove, by the first of his improvements (namely, that improvement relating to railway switches) the objections attendant upon switches of the usual construction. These objections being, as stated by the patentee, of two kinds,—one of which as an alternative it has hitherto been necessary to adopt, as follows,—When the point of the moveable tongue rail has been made sufficiently broad and strong to support the weight of the wheel and the load of the carriage, it became necessary to have a notch in the fixed rail to allow the inner edge of the point of the tongue rail to coincide with the inner edge of the fixed rail, so that there might be no impediment or interruption to the flange of the wheel upon passing the point, while the switch is closed; thus far, *while the switch is closed*, no important objection exists, as usually constructed, as they present an unbroken surface of rail to the passage of the carriage wheels; but the contrary is the case, when the switch is opened: the notch now presents its objections and disadvantages to action, the carriage wheels in passing striking against the side of the notch. The alternative of this objection is, making the depth of the notch much less; but to allow this, it is necessary to reduce the thickness of the point of the tongue rail, thereby rendering it too thin and weak to support the passing weight. These objections and disadvantages the patentee proposes to remove by the improvements in question, and which consist in cutting away so much from the upper table, and from the outer side of the middle webb of the moveable tongue rail, at the immediate point or extrem-

ity of such moveable tongue rail, as to enable the end of the same to pass under, and be housed beneath, the upper table of the side rail of the main line of rails, when the switch is closed. The wheels of the carriages in passing along the switch will not press vertically upon the moveable tongue rail in consequence of the end of the tongue being below and beneath the upper table of the side rail; but the flange of the wheel will press laterally against the side of the tongue rail; the wheel will pass a considerable distance along from the end of the tongue rail before it commences pressing upon it vertically, the upper table of the tongue rail being gradually developed as it recedes from the side rail, till, at a considerable distance from its point, it is of sufficient bulk and strength to receive the vertical pressure of the wheel without injury. The tongue rail still continues to develope itself for a further distance, where it is of the usual and proper form.

By these improvements, the patentee obviates the necessity of having a notch cut in the upper table of the side rail for the reception of the point or end of the moveable tongue rail, or the alternative of having the point or end of the tongue rail cut so thin, and thus so reduced in strength, as to be unable to support the pressure of the wheels and load when passing over it. Fig. 1 is a plan of a railway switch, made according to the most approved construction usually used, but with the points of the moveable tongue rails, D and D¹, made according to the patentee's method; A, A¹, the rails forming the main or through line of rails; B, B¹, the rails forming the branch line or siding; C, C, the chairs supporting the same; D and D¹, the two moveable tongue rails jointed to the jaw chairs, E, and sliding or moving laterally upon the table chairs, F, as usual; G, a rod or bar connecting together the two moveable tongue rails, and connected with any apparatus for the purpose of opening or closing the switch

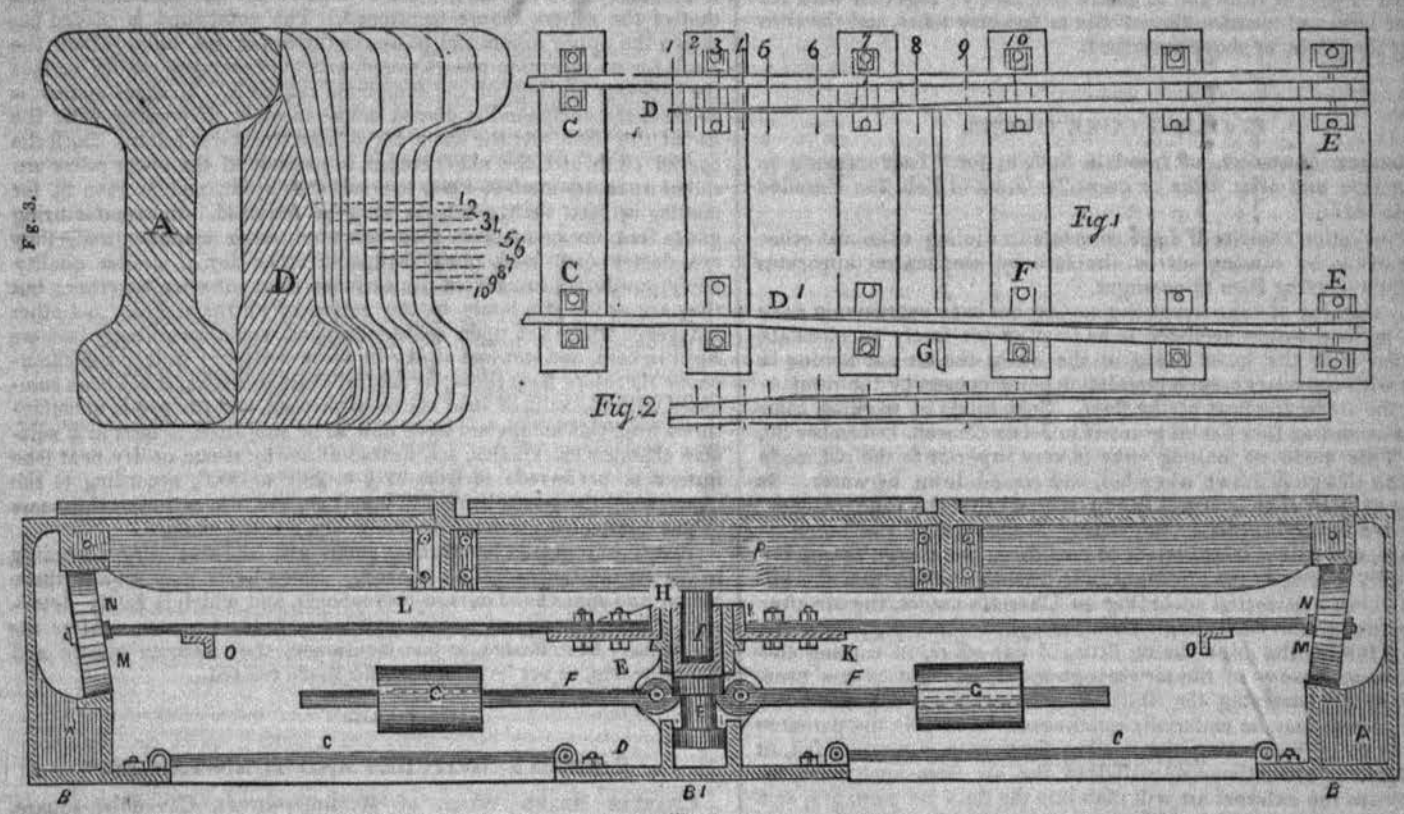


Fig. 4.

in the usual manner. The ends or points of the moveable tongue rails, D and D¹, being made and constructed, as represented by the dotted lines, in addition to the full lines in the plan, fig. 1, and also by figs. 2 and 3; fig. 2 being an elevation of the tongue rail D, showing the inclination of the top surface of the upper table of the tongue rail, D; fig. 3, a diagram upon an enlarged scale, representing, as will be hereafter explained, the contour or form of the tongue rail, by the sections represented, as taken at the points shown by the numbers 1, 2, 3, &c. By reference to the above, and the following description thereof, the form or contour of the moveable tongue rail will be at once apparent. 1, 2, 3, &c. (fig. 3), represent the point or end; and the sections of the tongue rail, D, figs. 1 and 2, taken respectively at the corresponding numbers thereon; thus describing and showing the form or contour of the said tongue rail, D, from the point or end of the same to No. 10, where it is the full size of the general body of the rail. The right-hand tongue rail, D¹, is precisely of the same shape or form as the rail D, but reversed, to suit the opposite side rail, A¹, of the line; should, however, the thickness of the upper table, or the breadth of the lower table, of the side rail, A, or A¹, exceed, or fall short of, or otherwise vary from the dimensions or proportions shown in the patentee's drawings, the patentee directs the moveable tongue rail to be made to conform to the form or contour of such side rail by cutting away more or less from the upper or lower table of the said tongue rail, so as to allow the point or end of the said tongue rail to pass under, and be housed beneath, the upper table of the said side rail; or a portion may be cut away from the under side of the upper table of the side rail, if sufficiently thick to allow this reduction, for the same object, without unnecessarily reducing the strength of the tongue rail.

The second improvement of the patentee relates to supporting and balancing the upper or moveable portion of turn-tables, and thereby lessening the bearing weight, and consequently the friction upon the moving parts; and it also relates to the position of the friction rollers or wheels placed beneath the outer edge of the revolving table or plate, by arranging them in such a position that the upper edge of the rollers shall be in one horizontal plane, or plane at the right angles to the centre line of the axles of the turn-table. Fig. 4, a sectional elevation of the turn-table; A, the lower or outer curb firmly bolted to the foundation, B, and fastened by the radial bars, C, to the centre plate, D; also firmly secured to the foundation B¹; E, a block of metal moving freely within the centre plate, D, and acted upon on the under side by the inner ends of the levers, F, F, of which there are two; the other end of the levers, F, F, carrying the counter-balance weights, G, G, adjustable upon the levers, F, F; upon the block, E, within the centre-piece E, rests the brass step, H, in which works the centre axes, I, of the turn-table; upon the exterior of the centre-piece, E, revolves loosely the disc, K, to which are bolted the radial arms or axes, L, L, carrying at their extremities the friction rollers or wheels, M; N, N, washers placed upon the axes, L, L, for adjusting the position of the friction wheels or rollers, M, thereon; these friction wheels or rollers revolve upon the raised portion of the curb, A, and carry the outer edge of the revolving table or plate, P; O is an iron ring bolted to and connecting the radial arms or axes L, together; the counter-balance weights, G, G, acting through the levers, F, F, upon the toe of the axes, I, of the revolving turn-table, P, relieve the friction rollers or wheels, M, from a very considerable portion of the weight of the revolving turn-table: thereby the friction is considerably lessened, and the turn-table moved with greater facility than by

the usual methods; the upper edge of the periphery of the friction rollers or wheels, M, being, the whole of them, in the same horizontal plane. The object of the arrangement and invention the patentee states to be, to allow any lateral motion of the upper or revolving plate of the turn-table to take place, without in any way affecting the pressure or position of the said revolving plate upon the friction rollers or wheels.

The patentee also states, the third part of his improvements to be, the arrangement of the rails upon the turn-plates, and the arrangement of turn-plates upon parallel lines of railway, to facilitate the removal or transit of carriages from one rail to another. This improvement simply consists in placing the turn-plates in such a position that a line passing through the centres of such turn-plates shall be at such an angle as shall divide the circle. The patentee giving two examples, thus: one in which the line passing through the centre of the turn-plate is at an angle of 60° to the line of rails; by their being placed in this position the patentee fixes upon the turn-table three lines of rails, and a carriage placed thereon has to be moved twice through 60° only, or one-sixth of a circle, instead of by the usual arrangement 90° or one-fourth of a circle. In the other example of the patentee's, the said lines passing through the said centre of the turn-plates are placed at an angle of 45°: in this example the patentee arranges upon the turn-plates four lines of rails; and a carriage requires to be moved through one-eighth of a circle, or 45°, twice, to place it upon another and parallel line of rails. By these arrangements, the patentee states, the turn-table is in a position to receive a carriage upon it, whether from the inclined line between the parallel or main lines, or from the main or parallel lines themselves.

The patentee, after specifying and describing his invention and improvements, states his claim to be; 1st. The construction and application of moveable tongue rails of railway switches, as hereinbefore described. 2nd. The construction and arrangement of railway turn-tables, by which the upper edges of the peripheries of all the revolving friction rollers or wheels are in one and the same plane, that plane being horizontal, or at right angles, to the centre line of the axes of motion of the upper or moveable plate of the turn-table, and thereby allowing lateral motion of the said upper or moveable plate upon the said revolving friction rollers or wheels, without injuriously affecting or deranging the perfect action of the said arrangement and apparatus. And the patentee also claims the construction and application of the lever balancing apparatus to the said turn-tables, as hereinbefore described. 3rd. The arranging and fixing the rails upon turn-tables, and the arrangement of the relative positions of the said turn-tables to facilitate the removal of carriages from one to another line of rails, as hereinbefore described.

HIGH-PRESSURE MARINE BOILERS.

The explosion of the boiler of the Cricket steamboat has given prominence to the question, whether high-pressure steam can be used with safety for the purpose of navigation. In considering the subject, however, at such a time, there is some danger that the judgment may be prejudiced, and a too-hasty decision given against the principle, when only the mode of carrying it into practice has been defective. It is most desirable to view the matter as freely as possible from the influence which such a disaster is calculated to produce, and to consider all the circumstances attending it, for the purpose of ascertaining whether they disclose any inherent danger in the use of high-pressure steam that no precaution can remove, or whether the accident was the result of recklessness on the part of those employed, or of want of care in the manufacturing engineer;—casualties altogether independent of the safety of high-pressure steam. We will in the first place compile a brief narrative of the event, collected from the evidence of those who witnessed the explosion.

The Cricket was one of three steamboats built on the same principle, and employed in conveying passengers to and from the Adelphi-pier and London-bridge, at the low fare of one halfpenny. On the morning of the 27th of August, the Cricket was at the Adelphi-pier, waiting for passengers. She had been waiting for ten minutes after having come from London-bridge, with the steam up; yet, during that time, nearly all the witnesses declare that there was no steam blowing off. The captain had gone ashore, and the person in whose charge the engine was for the day—not the regular engineer—was standing on deck near the funnel talking to the stoker. The call-boy was in the after-cabin, and not one of the persons belonging to the boat was in the engine-room. The number of passengers on board is variously stated at from 100 to 200. Suddenly a loud noise was heard, which is described by some of the passengers to have resembled the sound of rushing steam and rending iron, rather than a sudden explosion; others, indeed, compare the noise to the discharge of a cannon. The boiler casing was projected with great force through the after-part of the boat, which was completely destroyed. The whole flooring of the deck was blown up, the cabin was stripped bare, and the iron sides of the vessel, where it narrowed at the run, were laid flat, and the boiler casing was carried into the water. The steam chest was projected upwards, carrying with it the funnel and the outer case of the boiler, and shattering the bridge which connected the two paddle-boxes. The front plate of the boiler and the tubes were driven against the frame of the engine, which was much injured, but it fortunately arrested the progress of that portion of the boiler, and thus preserved the fore part of the boat.

An explosion attended with such destruction on the vessel must, of necessity, have told with disastrous effect on the numerous passengers. Those on the after deck were blown into the air: some fell into the water, and others descended among the ruins of the vessel. The number killed, however, is wonderfully small considering the destructive effects of the explosion. The lives lost were only five, and among them was the call-boy, who was boiling coffee in the after-cabin when the boiler casing swept through it. Even he, continued to live sometime after the explosion. It is a remarkable circumstance, also, to which we shall subsequently direct attention, that not one of those who were killed had been injured by scalding, and among the many who have sustained injuries by the explosion, very few have been scalded, and none of them seriously.

The foregoing is a brief *resumé* of the principal facts given in evidence before the coroner, respecting the explosion of the boiler and its effects; we have now to inquire for the cause of the disaster. The engine was constructed in accordance with a plan (patented by Mr. Smith, one of the proprietors of the boat,) in which the principles of high-pressure and of condensing engines are combined, and the result is reported to have been a great saving of fuel. The engines were made by Mr. Joyce. The boilers were tubular, having the fire contained in a tube three feet diameter within them. The boiler casing, which was cylindrical, was about five feet diameter and six feet long, with a hemispherical end at the after part, and it was made of $\frac{5}{8}$-inch iron. The steam chest was cylindrical, with a hemispherical top, and was composed of iron $\frac{5}{16}$ths of an inch thick. There were 66 tubes of $2\frac{1}{2}$ inches diameter inside and 4 ft. 9 in. long. The safety-valves were $2\frac{9}{10}$ inches in diameter, being flat and resting on flat seats. The length of the levers was 27 inches, and the fulcrum $2\frac{3}{4}$ inches. Of these valves there was one on each of the two boilers, which freely communicated by steam and water passages; and besides these lever-valves, each boiler had a Salter's spring-valve supposed to indicate 45 lb. on the index: there was also a mercurial gauge, for the additional guidance of the engineer as to the pressure of the steam. Neither of the boilers had any stays above the tubes, nor in the steam chest. With respect to the boat itself, the following specification for its construction, as agreed between Mr. Smith and Mr. Joyce, shows that it was intended to be put together in the best manner:—

"*Specification of an Iron Steamboat.*

Length on deck	. .	126 feet
Breadth of beam	. .	13 feet
Depth of hold	. .	7 feet

Draft of water 2 ft. 6 in., with machinery and coals on board. Is to be built of the best plates, flush jointed, and countersunk rivetted.

Plating of bottom lower streak, one-fourth thick;
Second, third, and fourth streaks, three-sixteenths thick;
Fifth streak, one-eighth full; sixth streak, one-eighth.

Angle iron frames 2 in. by 2 in., and 18 inches apart in centre of vessel, and towards the ends the angle iron to be lighter, and 24 inches apart.

Sleepers about 12 inches deep and one quarter thick, and of sufficient length to distribute the weight of engines and boiler over 30 feet length of vessel.

Keel and stems 6 inches by $\frac{1}{2}$-inch.

Bulkheads and coal bunkers $\frac{1}{2}$ full, $\frac{1}{2}$ bare.

Suitable half-round iron all round that portion of the boat designated the plank shear or gunwale streak, including sponsons.

Wood Work.

Shelf piece of best red pine	. .	5 in. by $2\frac{1}{2}$ in.
Beams, 24 inches apart	. .	$3\frac{1}{2}$ " $2\frac{1}{4}$
Plankshear of Quebec oak	. .	7 " $2\frac{1}{2}$
Deck, best yellow pine	. .	5 " $1\frac{1}{2}$
Shear streak of best red pine	. .	8 " $1\frac{1}{2}$

Paddle beams, spring beams, and rim pieces of Quebec oak.

Cabin floors of good yellow battens, one inch thick, on suitable bearers of red pine.

Cabins to be fitted up similar to the Ant and Bee, and the joiners' work

and fittings, skylights and companions, to be equal and similar to those vessels.

Glazing of the best character (with best bull's eye scuttles).

The whole of the wood and iron work to have three good coats of paint.

This vessel is to be fitted with a pair of engines of 16-horse power, each similar in principle to those on board the Ant and Bee, with a much improved and very powerful boiler. A good cabin stove in the after cabin.

And to be equipped with anchor, ropes, and everything for her station. A small winch at the head for her anchor, and all necessary fittings complete to go upon her station for work, and to include an extra donkey-pump, steam pressure gauge, vacuum gauge, and a Salter's balance on one safety-valve; the other safety-valve to have a weight in the usual way, and all necessary fire irons and spanners.

Speed to be equal to the fastest of the above bridge boats; consumption of fuel not to exceed 4½ lb. of good Welsh coals per indicator horse-power of (66,000) per hour.

Time of completion—All, May 1846.

I, William Joyce, do hereby undertake to make, construct, finish, and supply you with the whole of the before-mentioned works, viz., the iron steamer complete, with her engines, boiler, and fittings, in all respects ready to go to work upon her station, of the very best quality, best of materials and workmanship, and without any extra charge whatever beyond the sum now agreed upon, viz., Two thousand five hundred and fifty pounds sterling."

[The periods at which the money was to be paid having been specified, the agreement concludes as follows]:—

"In consideration of receiving the above order upon the terms specified, I also agree to put the engines and boiler which I have already been paid for into the new steamboat building by Messrs. Ditchburn and Co., called the Cricket, and to complete the same engine and boiler in every respect fit for work upon her station (with the exception of half the cost of a donkey pump, pressure gauge, and Salter's balance, which has been settled at £12), before the expiration of the present month.

Signed by both of us upon the 11th day of February, 1846. } O. H. Smith, W. Joyce.

Witness to the above signature, Bn. Nash."

The agreement, it will be observed, stipulates for one boiler only, but Mr. Joyce afterwards undertook to put in two smaller boilers instead of it, as he considered they would be safer. Mr. Smith, when examined before the coroner, said he had every reason to believe that Mr. Joyce had adhered strictly to the terms of the contract, and that the boat and the engines were constructed according to the specification. It appears, however, from the terms of the agreement, that nothing was specified as to the form or strength of the boilers, which were left entirely to Mr. Joyce, under the stipulation that the engines were to be of 16-horse power each, "with a much-improved and very powerful boiler," and to work with a given quantity of fuel. Whether Mr. Joyce took any and what precautions to test the strength of the boilers before he put them into the boats, has not at the time we are writing been given in evidence; but the lever-valves were weighted to rise at a pressure of 40 lb. to the square inch, and the spring-valves were screwed down to 45 lb. During the whole examinations not one witness has spoken to having seen the steam blowing off at the spring-valves.

The circumstances that have been elicited during the investigation tend strongly to throw the blame of the accident on the gross mismanagement of those who had the charge of the boat. More careless and reckless conduct was scarcely ever disclosed, and the surprise is, not that the boiler burst on the 27th of August last, but that it did not burst at any time during the last six months. Clark, the engine-driver, who was appointed to the Cricket at Easter last, appears almost from the first to have pursued the plan of tying down the lever safety-valves when the boat was in motion, and the fact seems to have been so notorious that many persons avoided going on the boat, and a "blow up" was spoken of as an occurrence to be daily expected. Notwithstanding the notoriety of the fact among the persons connected with the Cricket boats, that Clark was in the habit of tying down the valves, the managing proprietor seems to have been so blinded by the plausibility of that man's statements, and by confidence in his veracity, that he dismissed Edwards, the stoker, who had complained to the captain of the danger of the practice, without any inquiry. There is indeed an attempt to deny, on the part of some of Clark's friends, that the valves were tied down; but the evidence of the fact is too strong to be doubted. Among others who deposed to having seen the levers tied down, was Mr. Meachem, the foreman of Mr. Joyce, who was driving the engine one day in the absence of Clark, and when he found the levers tied he instantly cut the strings, remarking at the time that he knew what the boilers would bear better than Clark. The boat seems to have been frequently entrusted to the care of persons quite incompetent to the duties of managing the engine, and among others to whom the charge was committed was a man who six months before had been the porter at a seed warehouse.

The evidence of the stoker who succeeded Edwards made the case still stronger against Clark than his predecessor. He said that he had regularly tied the valves down by the order of Clark when the boat got underway; that the pressure indicated by the gauge was sometimes 80, and that the boiler and condenser often became so hot that the steam would not condense, and the engine-room became filled with steam. All parts of the boat became hot in consequence, and it was no uncommon thing at such times for the people on deck to call out, "All hot, all hot!" He further stated, in confirmation of the preceding evidence of Clark's recklessness, that he would sometimes start the boat before the water in the boiler was up to the bottom cock, and that on Sundays, when the boat was most crowded, he would have friends drinking with him in the engine-room, and "practising driving engines." As an instance of the strains the boiler sustained by the extreme pressure caused by tying down the valves, this witness said that,—

"On one morning, about three weeks after he had been on the boat, on proceeding to light his fires, he found the water all gone out of the boiler below the first row of tubes; in fact, below the lower cock. The water escaped through a tube which was split the previous day by a pressure of steam. On observing the want of water he began pumping, and pumped an hour and a half, when he found the water continued to run out as fast as he pumped it in. He did not notice anything particular the previous day. The valves were tied that day under the general orders. That was one Sunday morning. Clark had not arrived at the time he found the defect in the tube, having gone down to Greenwich the previous evening. Witness went on board the Bee, and told Mr. Buttriss of the split in the tube, and while Mr. Buttriss was looking at it Mr. Clark arrived, who proposed to caulk the tube, but Mr. Buttriss said that as the pressure would be the same as on the boiler, it would not answer the purpose, and proposed that it should be repaired by an iron bolt and washers. That plan was adopted. A round iron bar as thick as his finger, was placed through the tube—a washer placed on each end, and a joint made between the washer and the boiler. Witness pumped the engines to fill the boiler after that, when it leaked a little at first, but when they were running and the water got hot, it did not leak at all. Four days or a week after that occasion, he found the water leaked from a joint of another tube, where it was made fast to the boiler. There was no split in the tube. After pumping an hour, Mr. Buttriss came on board, and with the assistance of Mr. Ball, the mate, the danger was repaired, so that they could run. He believed it was hammered round."

In addition to the wanton sporting with human life on the part of the engine-driver, which the evidence discloses, there appears also to have been culpable misconduct by the persons employed to manage the affairs of the company. The engineers and stokers are represented to have been kept at work from five in the morning till twelve at night, being exposed during a portion of the time to a temperature of 100°. The incessant working of the three boats belonging to the company caused also greater difficulty with the boilers, there not being time to blow out the water and examine the boilers, as in other steam vessels; and the dismissal of Edwards, without inquiry, for complaining of the conduct of Clark, seemed effectually to prevent other complaints from being made.

It will be observed from the summary of the evidence we have given relating to the cause of the accident, that the question of the comparative safety of high-pressure and low-pressure engines is in reality scarcely involved by the explosion of the boiler of the Cricket. By tying down the safety-valves any boiler might be burst, and a low-pressure boiler would have the less chance of escape under such treatment. We have as yet no minute description of the construction of the Cricket's boilers, as Mr. Lloyd, the engineer appointed by the Board of Trade to investigate the matter, has not at the time we write made his report; but from the account given by Mr. Galloway and others, there appears to have been a want of proper stays in the steam chest and boiler casing. The safety of tubular boilers arises from the comparative weakness of the tube fastenings, by which when the pressure becomes dangerous the steam escapes through some small rent, and the pressure is relieved by the escape of steam. This principle might be still further applied, so as to render an explosion, in the ordinary meaning of the word, next to impossible.

There is one point that especially deserves notice with respect to high-pressure steam, which renders it in some respects a much safer force than steam of low pressure. *High-pressure steam does not scald.* Among the deaths and serious injuries inflicted by the explosion of the Cricket's boiler, we do not find that any one has been seriously scalded. One person who was blown from the deck, says, that he felt himself struck on the head by the steam, but he experienced no sensation of heat. We are ac-

quainted, by experience, with the fact that there is no heat given out by high-pressure steam when escaping into the air, having often held our hand in a jet of steam issuing from a pressure of 100 lb. to the square inch. It is only when such steam regurgitates, if we may so express it, that it gives out heat and scalds. When, for example, a jet of steam strikes against a solid body, and its issuing force is arrested, then it scalds; but when it has free room to expand, the sensation produced is that of cold, and not of burning. It may be remembered that when by the separation of the pipe of the boiler in an engine constructed by Messrs. Samuda, at Blackwall, several persons were killed, they all lost their lives by the scalding of the low-pressure steam. The high-pressure steam of the Cricket's boiler, on the contrary, did not seriously injure a single individual. This extraordinary property of high-pressure steam should form an important consideration in determining the comparative safety of the two kinds of engines, yet it has hitherto been disregarded.

Since the foregoing remarks were written, the evidence of Mr. Lloyd, chief engineer and inspector of machinery of the Royal Navy, has been given at the adjourned inquest, held on the 22nd September, and we subjoin the greater portion of it, divested of the repetitions consequent on examination by different counsel. Some parts of his statements relative to the construction of the boiler and the pressure borne on different parts are not very clear or comprehensible, but his evidence proves that the boiler, however defective, was capable of bearing a pressure twice as great as that which would have lifted the weighted valves, if they had not stuck or been tied down. The corresponding boiler of the Cricket gave way under a pressure of 136 lb. to the square inch, but it had previously suffered a great strain by the pressure which caused the explosion, and therefore its strength at the time must have been much greater. Mr. Lloyd is of opinion that the other boiler must have had a pressure of at least 136 lb. to the square inch before it exploded.

Clark, the engineer, was examined after Mr. Lloyd, and he declared that the statements of the other witnesses against him were false, and that he never gave directions to Edwards nor to any one to tie down the valves. He seems to make a nice distinction between tying them down and twisting the end of the string fastened to the lever round a nail. He denied, however, that the string was ever tight, and he said that the object of twisting the ends round the nail was to prevent them from dangling and being in the way.

Mr. Lloyd's evidence was to the following effect:—

The Engines.—"With regard to the engines themselves, I do not think many observations necessary. They are high-pressure engines, on the principle well known as Wolfe's. Each engine has two cylinders; in one the steam is used at a high-pressure, and, instead of passing into the open air, as in an ordinary high-pressure engine, it passes into the second and larger cylinder, whence it passes into the condenser, and is there condensed in the ordinary way. The object of this arrangement is of course the saving of fuel, by effecting a saving of steam, and, therefore, of fuel. So far as I saw, the materials and workmanship of the engines were good. As compared with high-pressure engines, there is nothing objectionable in these engines, in point of danger—nothing but the ordinary construction. There were attached to the engines two pumps for feeding the boilers; another pump was worked by an auxiliary engine, which was commonly called the 'donkey;' and there was a fourth pump, to be worked by the hand, for feeding the boilers. These appeared to be all that was necessary.

*The Boilers.**—There were two boilers, consisting of an external cylinder, five feet in diameter, having a hemispherical end at the back, and the front being composed of a flat plate. To this flat plate are fixed a cylinder, forming the furnace, and all the small tubes through which the products of combustion pass. The internal part of the boiler, consisting of the furnace, the fire-box, and the small tubes, were secured to the shell by the rivetting round the circumference of the front plate, and by two stays, one fixed between the end of the fire-box and the end of the boiler, and the other fixed obliquely between the top of the front and the upper part of the shell. A steel dome was also rivetted to the top of each boiler, on each of which were two safety-valves, pressed down by levers, one lever having a weight at its end, and the other a spring-balance—Salter's balance. The thickness of the tube plates was $\frac{3}{4}$ inch; of the front-plates, those on the top and bottom of the tube-plates, $\frac{7}{16}$ inch; the shell $\frac{5}{16}$ inch. The front of the boiler consisted of three plates, one of these being the tube-plate, and the others the plates above described. The steam-dome is $\frac{6}{16}$ inch; the angle-iron round the front of the boiler is 3 inches by $\frac{1}{2}$ inch. All the other angle-iron is $2\frac{1}{2}$ by $\frac{3}{8}$ inch. The rivets in the boiler are $\frac{3}{4}$ inch diameter, and the rivets in the steam-dome rather smaller. That includes the rivets in the shell; all the rivets of any importance are $\frac{3}{4}$ inch. Assuming each boiler to be of the power of 16 horses, the total heating surface in the boiler is 14·8 square feet per horse power. The area of the fire-grate is 55-100ths of a foot per horse power. There is nothing objectionable in these proportions, either in the amount of area of fire-grate or of heating surface. The quantity of water in the boiler up to the middle gauge-cock is about 38·1 cubic feet per horse power; and the steam-room about $1\frac{1}{2}$ foot per horse power; that is including the dome and the other part of the boiler.

The Valves and Pressure.—I have calculated the pressure upon the safety-valves, supposing the weight to be at the extremity of the lever, at very nearly 66 lb. per square inch. Taking the spring-balance as it was when I saw it, the pressure per square inch when the valve was just about to open, would be 40 lb. per square inch; but if the valve were as wide open as it could be, this spring-balance would produce a pressure of about 170 lb. per square inch. Both valves are lever valves; one is pulled down at the end by the spring-balance, the steel-yard, the other is operated on by a weight. As the lever of the spring-balance rises, by the valve opening, the pressure on the valve increases, and rises to 170 lb. at the highest. One pound on the spring-balance produces a pressure on the valve of nearly two pounds. These valves operate jointly on the boiler, both serving to empty it of steam; but they operate separately from each other. I think if they had all been properly in operation, the steam could not have accumulated in the boiler to any dangerous extent—that is, supposing them not to have been overloaded. I do not approve, certainly, of the arrangement of this spring-balance valve; it is objectionable because, when the valve has been raised to such a height as to relieve the boiler considerably, the pressure brought upon it is very greatly increased, the power of the lever being nearly as 10 to 1. This is not the usual way in which spring-balances are used, so far as I know. I think the principle wrong, on account of the pressure being increased when the valve opens. I think it wrong in principle to put a spring-balance at the end of a long lever. I altogether object to valves being in the power of the engineer to load at his pleasure, especially the high-pressure ones; but it is only fair to say that this is too commonly the case. It can scarcely be a matter of opinion that this is wrong in principle. Nothing in the weighted valves called for observation, except that if it had not been intended to work these boilers at a pressure of 66 lb. to the square inch, such a weight as that ought never to have been put upon the lever. The same remark applies to the spring-balance valve, because it can be screwed down or up to any extent. The weight being upon the lever was objectionable, as it would be an indication to the engineer that he might use it in any way he thought fit, so as to obtain that pressure, namely, 66 lb.

Opinion on the Strength of the Boiler.—As to the construction of the boiler, I may say that, in my opinion, it is dangerous to be used as a high-pressure boiler. The whole of the pressure of the steam within the boiler is brought, either directly or indirectly, upon this flat plate in the front. I find, when the pressure of steam is 66 lb. on the square inch, the direct pressure on this plate is 83 tons, which is withstood entirely by the stiffness of the plate itself, with the small addition of the two stays before-mentioned. I do not believe that 66 lb. on the inch would have burst the boiler at present, though it might have done so when the boiler was somewhat older. The objections which naturally lie against a flat plate of this kind are these: In the first place, you cannot calculate what it ought to bear; the pressure on the inside of it tends to produce three different effects. First, there is a strain brought upon it at right angles to the surface, and, if the plate were perfectly rigid, there would be no other effect; this not being the case, an enormous pressure is brought upon it in its own plane, which may be illustrated by considering the effect produced on a musical string when pressed sideways, the force brought to bear upon it lengthways being far greater than when stretched in that direction. A third action is produced by the bending of the plate, the outer circumference remaining nearly

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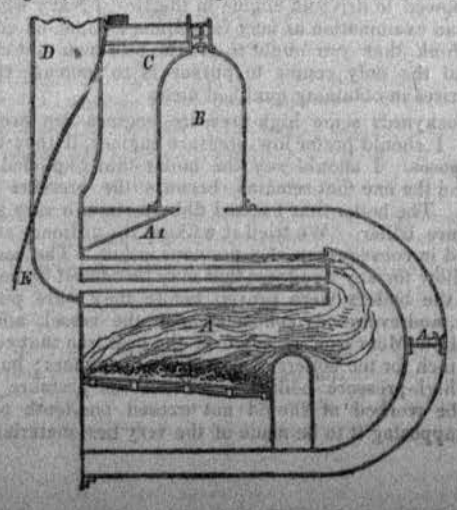
* [The annexed diagram, from the "Mining Journal," is a section of the boiler showing the position of the two stays, the only ones in the boiler. A 1, is the stay at the front, leading from the front plate, in a diagonal direction, towards the steam dome; this stay being formed out of $1\frac{1}{2}$ inch square bar-iron, flattened out at the end with an inch hole, and supported by a pin passing through two $2\frac{1}{2}$-inch angle irons. A 2, represents the other stay, leading from the back of the boiler to the end of the flue, which communicates with the tubes. A, the furnace, about 3 feet in diameter. B, the steam dome, to which two safety-valves were affixed. C, steam-pipe, leading from the box of the safety valve to the funnel D. E, represents the spun-yarn, with which it is supposed the valves were made fast.]—Ed.



in the same plane, and the inner part being considerably bulged. From the best examination I can give the subject, I have come to the conclusion that the strength of this front plate, aided by the two very imperfect stays which were put in the boiler, was not sufficient to bear, for a length of time—that is, during the usual time a boiler may be supposed to last—a pressure of steam of 60 lb. on the square inch. At present it would bear it, no doubt; there is no question of that. If any person wished to tie down the weighted valves he would, most likely, prevent the spring-balance valves from working, which he might easily do by putting in a piece of wood.

I have calculated, in a rough way, what would be the effect of keeping all the valves tied for five minutes. Supposing no steam were permitted to escape, and the pressure was 60 lb., at the end of five minutes it would increase to more than 90 lb.; and, at the end of ten minutes, be between 130 lb. and 140 lb.; in a quarter of an hour, at least 180 lb. That is, supposing no steam escaped, that the fires were burning briskly, and the boiler in full operation. I cannot conceive four valves getting out of order, or sticking, at the same time. One valve, supposing the other three to be fast, would not relieve the boiler of steam as fast as the steam was generated, looking at the size of the steam-pipe. If two were in operation, one of Salter's, and one of the others, they ought to relieve the boiler; but the area of the steam valve is larger than that of the waste steam-pipe, which is not a good arrangement. The area of the former is nearly five inches, of the latter, only 2·7 inches. If the two weight-valves were tied, and the spring-balances free, I think a dangerous pressure would be brought upon the boiler.

Test of the Tenacity of the Plates of the Boilers.—After making an examination of the boiler, I thought it proper to test the goodness of the materials; for which purpose I took pieces of the plates of the boiler which had been rent by the explosion. These plates, as I said before, are ⅞-inch in thickness. I cut strips of two inches in width from them, both with and against the grain, and tore them asunder by a machine for that purpose at Woolwich. Four of the pieces produced are four of the strips of the boiler; two torn with, and two against the grain; the other four pieces are good metal from Woolwich, with which I compared the former. The former, are, in fact, part of the plates which were rent in the explosion. Without troubling you with the details of the experiments, I may mention that the average tensile force per square inch of these plates was 17 tons, that of plates of the same thickness, of the best kind, which I tried at the same time, was 21⅝ tons. Specimens of those are also produced. They are Low Moor plates, of the same thickness, but of a very superior quality. The plates of the Cricket are very much laminated or shelly, not only in one part but all that I saw. This is owing to the bad quality of the metal. It will happen sometimes in plates of the best quality, but it is very much to be avoided. This piece exhibits the fracture actually made by the explosion, the appearance of which proves it to have been bad iron—that is, for the purpose to which it was applied, to a high-pressure boiler, and considering that it was employed in the part which was most likely to break. I tried also some common Staffordshire plates at Woolwich, and found their strength nearly the same as that of the Cricket's plates. They bore 16⅝ tons on the average, which is very low.

I do not consider the workmanship of the boiler to have been such as it ought to have been in a boiler of this kind. The rivets generally did not fill the holes, and they were generally not sufficiently long to make a good rivet. The boiler does not appear to be seriously deteriorated by wear, except at the lower part of the front, and possibly the bottom too may be so; but I do not attribute the explosion to that. The part which exploded was the whole of the front, which was torn out bodily. Of course the part was weaker than when quite new, but not materially so. The experiments I have mentioned are not tests of the pressure of steam on the plates. All we can is, that a pressure of 60 lb. ought not to be permanently put upon them, say for three years. From these experiments, and another of bending the iron, I should say that the metal was not such as ought to have been employed. It was good common metal, such as is usually employed in the boilers of the navy for parts where there is no great strain; but not such as ought to have been put in the front of the boiler. The plate was torn where it was weakest, and in the stronger part it was torn from its fastenings

By consent of Mr. Smith, Mr. Joyce, and other parties interested, who have afforded me every facility, I have made experiments on the unexploded boiler. I brought on it a pressure of 136 lb. to the square inch, showing that the other must have been subjected to a very severe pressure. In the unexploded boiler both the stays were separated, and a part of the angle-iron, which unites the front to the shell of the boiler, was cracked. Upon this boiler I brought a pressure of water of 136 lb. on the square inch, and then the boiler leaked to so great an extent that a greater pressure could not be obtained. My opinion is, that the pressure of steam which caused the explosion could not have been less than 136 lb. to the square inch. That is, of course, a matter of opinion; but it is the conclusion to which I have come. I should not have expected it to burst with a less pressure; but, as I said before, it is utterly impossible to calculate it. You can calculate perfectly well what the shell of the boiler ought to bear. I should say it was not less than 136 lb.; how much more I cannot say. I do not believe there is any reason to suppose that there was any deficiency of water in the boiler. It is called a tubular boiler, from the circumstance of a number of small tubes being introduced, for the purpose of absorbing the heat. We consider them rather a safe boiler. The business of one or two of these tubes is a matter of no importance. The tubes seemed to be all perfectly good. Two or three of them were bent, but the cause of that was very evident from striking against the inside. My great objection to the boiler is its form, the front being flat, without proper staying; and, in a far less degree, the quality of the materials and the workmanship.

Cause of the Explosion.—There can be no doubt as to the cause of the explosion—namely, the improper increase of the pressure of the steam shortly before and at the time of the explosion. If the pressure was gradually increased, say from 60 lb. to 130 lb. or 140 lb. in the course of ten minutes, that would be enough to account for it—certainly, if the pressure rose to 150 lb.; but that is a mere matter of opinion. That the boiler had never before been subject to such an extreme pressure is evident from the fact that the other boiler leaked considerably at almost no pressure at all: and I consider that it had been rendered thus leaky by the extreme pressure on the day of the explosion. The boilers are connected in the water spaces and in the upper part of the steam, so that the pressure on both would be the same at the same time. If only one valve was in operation on one boiler, the pressure on both would be the same; and even if both valves of one boiler were secured so as not to work. To show the great pressure brought on the unexploded boiler, I may mention that the flat plate in front was bulged to the extent of 1¾ inches before I commenced my experiments. After it had been subjected to the water-pressure of 136 lb. on the square inch, the bulging of that plate increased to 2·16 inches; and the lower front plate of the boiler began to break exactly like the one that was broken in the exploded boiler. Had all the four valves been at liberty, it appears to me impossible that the pressure of steam could have so increased as to cause the explosion. Had both the balance-valves been open, I think they would hardly have saved it; they might have deferred the time, and prolonged it from ten to perhaps twenty minutes. I think the valves must have been closed, or open only to a small extent, when the explosion occurred. [Here Mr. Lloyd exhibited a plan of the vessel and boiler, and explained to the jury how he conceived the explosion to have occurred.] When the front began to bulge the stays would be the first to go; the plate would then bulge more and more, and the moment the separation took place the inside of the boiler would be projected in one direction, and the shell in another. The former was driven against the engine, which resisted it, and to this the people in the fore part of the vessel owed their safety. The shell of the boiler was carried in the other direction, and tore away everything in the stern part of the vessel. Assuming the actual gross pressure at 180 tons, and adding a ton and a half for the weight of the shell, it would give a force a hundred times greater than that of gravity, which will account for the enormous power exerted in a comparatively short space of time.

You can always raise a valve in a well constructed boiler, but not pull it down. The engineers in the Royal Navy have not access to the valves; in locomotives the engineers have access to the safety-valves. I found the spring of the unexploded boiler correct; as nearly as can be calculated, it was about 40 lb. per square inch when the valve was shut, but as the valve opened the pressure increased. For anything I can tell, the safety-valve was not permitted to rise in the unexploded boiler. If both the Salter's balance-valves had been in a fit state, a longer time would have been necessary to get up the steam to the bursting pressure. I cannot tell whether they would have opened sufficiently to let out the steam of themselves; I doubt very much whether they would. The waste pipe of the Cricket is small, and is a bent pipe, and all that impedes the passage of the steam into the chimney, but to what extent it is impossible to say. The noise would have been very great if any of the valves had been acting, and the steam had been 5 lb. above 40°. There were two stays to the unexploded boiler; both had been separated. Either sudden or gradual pressure would have accounted for that separation. The stays themselves were strong enough; it was the fastenings that had given way. If the valves were closed at 60°, the pressure would in five minutes have got up to 90°. I know very few engineers who understand these matters thoroughly. I wish we could get people who did understand them; but no man is allowed to drive an engine in the Royal Navy who has not undergone such an examination as may from time to time be considered necessary. I think that you ought to get the best men that can be got as engineers, and the only course to pursue is to increase the wages, if any difficulty arises in obtaining qualified men.

In the dockyards some high-pressure engines are used for particular purposes. I should prefer low-pressure engines, if they were suitable for those purposes. I should say the boiler that exploded must have been weaker than the one that remains, because the pressure would be alike upon both. The boiler that I tested did not stand a very severe test for a high-pressure boiler. We tried it without the ordinary stays; and it was then bulged in consequence of a previous strain. The maker of a boiler ought to allow for any weakness that may be caused by corrosion. I have been told the boilers were proved before they were put in the Cricket. Mr. Joyce, and everybody connected with the vessel, afforded me every facility. Low Moor iron is some of the best iron that can be got. It is not used much for the boilers of commercial steamers; but it ought to be used for high-pressure boilers. I think the pressure a steam boiler ought to be worked at should not exceed one-tenth of its calculated strength, supposing it to be made of the very best materials and workman-

ship.* Almost all tubular boilers have flat plates in front. If I used a flat plate, I should construct it in such a manner that the stays themselves might sustain the entire pressure. If the valves were tied down and the boiler was subjected to a strain of considerably above 66 lb., the effect would be gradually to weaken the boiler. All the parts of the boiler made to resist the straining would be acted upon by such a constant pressure. The dome would not be affected by the pressure of 136 lb., which I applied to the unexploded boiler. The vulnerable part of the boiler is the bad plate in front."

The inquest was again adjourned, and was resumed on the 24th, when several additional facts were elicited. Heasman, the person who acted as engineer on the day of the explosion, denied positively that the valves were tied down, and he said that only a minute before the explosion the gauge indicated a pressure of but 38 lb. to the square inch, and the steam was blowing off slightly from the loaded valve. He was equally positive that there was no string whatever attached to the lever of the larboard boiler at the time, as it had been shaken off on the Sunday morning previously, and had not been replaced. Mr. Lloyd was again called, for the purpose of explaining a few points of his former evidence. He stated, in confirmation of his opinion that the pressure at the time of the explosion must have been at least 136 lb. to the inch, that the companion boiler had been so much strained at the same time, that it could not have worked afterwards, owing to the leakage; and yet, in this weakened condition, it bore a pressure of 136 lb. to the inch before it gave way. Mr. Joyce and his foreman, Mr. Meacham, gave evidence. The latter states that when the boilers were delivered from Mr. Trotman's, of Whitecross-street, Borough, they were proved to a pressure of 150 lb. to the square inch. The boiler was again proved to a pressure of 150 lb. on the 3rd of August, when the tubes were repaired. That pressure was not observed to make any impression on the boiler. When he visited the boat on the 23rd of August, he ordered the strings on the levers to be cut away, as there had been a talk about Clark having tied down the valves; but, having himself confidence in Clark, he did not believe that he "had ever done so wicked a thing." Had any one of the four valves been in operation, he was of opinion it would have been enough to relieve the boiler from dangerous pressure. The weight on the lever would be equivalent, as stated by Mr. Lloyd, to a pressure of 66 lb., if placed at the end of the lever; but it never could be brought within three inches of the end, owing to the waste steam-pipe, and the pressure could not then exceed 56 lb. or 57 lb., or, with the lever and valve, 59 lb. Mr. Lloyd's proof was made after the boiler had lost its stays. Had it been made when the boiler was new, and with the stays in, he believed it would have supported a pressure of 250 lb.

Mr. Joyce said that Mr. Trotman had his own price for the boilers, and he had reason to believe they were quite sound. In reference to Mr. Lloyd's opinion, that boilers ought to be proved to ten times the working pressure, Mr. Joyce observed that he never knew a boiler that would stand such a test. The front plate of the Cricket's boiler was made of B. B. H. iron, which is of very good average quality. The boilers of the Ant and Bee are of good Staffordshire iron, and the tube plates are not so thick as those of the Cricket.

Mr. Trotman, the maker of the boilers, gave the following evidence:—

"I have been a boiler-maker from my youth. I furnished the boilers of the Cricket. Mr. Joyce said they were to work from 40 lb. to 50 lb., but never to exceed 50 lb. I proposed to prove them to 100 lb, and Mr. Joyce said he should be very well satisfied. When they were done, he offered to prove them himself, after they were delivered, and I consented. I filled them with water, to discover any leaks, but did not prove their strength. I saw the exploded boiler the Sunday after the accident. I concluded there had been some unfair work. I don't think that any ordinary pressure could have bent the plate and torn the angle-iron, which was very strong. I had the iron from Messrs. Moser, in the Borough: I paid 15*l.* a ton for the tight iron, and 20*l.* a ton for that of the two plates. I have worked tons of the B. B. H. iron, and consider it next to the Low Moor. The engineers fix on the safety valves. With fair pressure and fair work, those boilers would have worked for years. They have been known to work at 80 lb., and that is much more than I was told would be required, I have never known a boiler so strong as to resist a pressure ten times the ordinary amount. This accident must have been occasioned by pressure, which must have been excessive to send part of the boiler, weighing perhaps a ton and a half, through the stern of the boat, and about forty yards through the water."

Mr. Robert Rettie, of Ham, civil engineer, though he admitted he had never seen the valves nor the boiler, spoke confidently that the cause of the explosion was the overheating of the flues, that the stoppage of the valves was quite inadequate to account for the explosion, and that the pressure must have been nearer 300 lb. than 150.

The evidence having been concluded, the coroner (Mr. Bedford) summed up, and the jury, after deliberating for an hour and fifty minutes, delivered the following verdict:—

"We find that Thomas Shed, John Blunt, John Littleton, George Shute, and John Buckley came to their deaths by the bursting of the boiler of the Cricket steamboat, on the 27th of August, 1847. We find a verdict of *manslaughter against Henry Heasman*, the engineer on that day. We consider Clark highly culpable, and unfit to hold the situation of engineer. We likewise consider Mr. Smith's conduct shamefully neglectful in not properly investigating the complaint made against Clark."

The foreman stated that they were unanimous in their verdict. The inquisition was then signed by the jurors, and the coroner made out his warrant for the commitment of Heasman.

Thus has terminated this important inquiry, which lasted seven days, and on the last occasion the jury sat from ten in the morning till ten at night. In an engineering point of view it possesses great interest, and the evidence given respecting the explosion, and the experience gained by it, will, we trust, operate in giving additional protection to the public against such disasters in future.

* [We think Mr. Lloyd must here allude to low-pressure boilers, where the steam is rarely generated at a higher pressure than 10 lb. or 12 lb.]—Editor.

CONSTRUCTION OF PENITENTIARIES.

The following propositions on the construction of prisons were discussed at a meeting of delegates from the different European Governments, met last month at Brussels, to take into consideration Penitentiary discipline. The meeting was attended by Major Jebb, sent over by our Government, Mr. Rotch, and Mr. Pearson, from England:—

"The buildings should be disposed in such manner as to facilitate the various duties, without any confusion. To that effect it is indispensable to separate the prison, properly so called, from the accessory localities destined for the directors and other persons employed. The external communications may be maintained without exercising any influence on the preservation of order within. With that view messengers, purveyors, &c., should never come into contact with the prisoners. Each branch of the service should be carried on in some respects in an independent manner, with reference, however, to the principal direction from which it receives its impulse.

Central Observatory.—The various parts of the building should be connected with a central point of inspection, from which the head of the establishment may inspect, without being under the necessity of moving, all the essential branches of the service. Regard must be had to the internal distribution of the localities, to the arrangement of the galleries, and to the choice of the materials of construction, in order that no material obstacle may thwart that inspection.

Cells.—In the disposition and arrangement of the cells, regard must be had to the following conditions:—1st. The cells must be large enough to allow of the prisoners' taking exercise, carrying on trades, and enjoying sufficient space and air for the preservation of their health. The space should vary from 28 to 35 cubic metres. 2nd. They should be lighted up, ventilated, and heated in a suitable manner. 3rd. Their construction should be such as to allow of no communication between their inmates. 4th. They should be furnished with bed and bedding, with a fixed wash-hand basin with a tap, with a water-closet and with other necessary articles. The prisoners should also have the means of giving the alarm to the attendants in case of illness or accident, or under any circumstance in which their presence might be necessary. 5th. The prisoners should be subject to an easy but unperceived inspection.

Special Cells.—In penal prisons it is necessary to have a certain number of special cells for the infirmary, for special punishments, for the different cailings, and for prisoners on their first arrival. The cells for infirmaries, chiefly reserved for patients who cannot be suitably attended to in the ordinary cells, should be more spacious than the former, and should be disposed in such a manner as to allow of the free access of the attendants. One cell of that kind for every 40 or 50 prisoners would possibly be sufficient. Cells for punishment should be stronger than others, and should be built in such a manner as to be easily darkened, if necessary. One such cell would be sufficient for about 100 prisoners. The dimensions of the cells for the exercise of certain trades should correspond with the use to which they are to be put. They should be situated in preference on the lower stories, and their number must depend on the nature of the trades carried on in the prison. In prisons where prisoners are constantly arriving, a certain number of cells should be made in which each prisoner may be placed temporarily, previous to being seen by the surgeon, and such cells might be of smaller dimensions than others.

Heating and Ventilation.—Whatever the system of ventilating by heating may be, its results should be the following:—A sufficiency to each

cell of fresh air, or, if necessary, of air tempered for each prisoner, without the inconvenience of draughts. The extraction from each cell of a quantity of foul air equivalent to the quantity of pure air introduced; and the carrying on of the heating and ventilation without facilitating the means of communication, whether of sound or otherwise, between the different cells."

IRON VESSELS.

The following report of a survey for the purpose of ascertaining the injuries sustained by the *Great Britain*, has been delivered to Captain Claxton. It clearly shows the superiority of iron over wood for constructing sea-going vessels.

"We, the undersigned, certify that we have at your request this day been on board the steamer, Great Britain, now lying on the gridiron in the Prince's Dock Basin, and both inside and out have examined the means adopted by the foreman boiler maker, Mr. John Crew, for stopping the leaks in the bottom of the vessel whilst lying in Dundrum Bay. We find the principal holes to have been six in number, varying in dimensions from 2 ft. by 12 in. to 5 ft. 9 in. by 16 in.; and there are other formidable holes and cracks of smaller dimensions. From their size and position, under the keel of the ship, we are of opinion that it must have been a work of extreme difficulty to make them in any degree water-tight. We are informed that, besides the water in which the ship lay, there was never less than 2½ or 3 feet of water and sand in her hold after the damage she sustained from the gales in the early part of the winter; and taking this fact into consideration, with the other difficulties that had to be encountered, we are of opinion that the greatest ingenuity and perseverance must have been exercised to stop the holes in such a manner as to enable the vessel to float. The method adopted by Mr. Crew for this purpose was as follows:—A plate of sufficient size was passed edgeways through each hole from the inside, having a screwed bolt attached to it as nearly in the centre as possible. This plate was then adapted to cover the hole on the outside, and was drawn tight up by a screwed nut and crossbar from the inside, being packed with felt to prevent leakage as much as possible. On the whole, as boiler-makers' or iron ship builders' work, we consider it to be a most extraordinary performance, which, regarded from before-hand, must have appeared of almost hopeless execution, and must have been one of the greatest amongst the numerous difficulties over which the energy and determination of the rescuers of this vessel have ultimately triumphed. We do not conceive that it would have been possible, under similar circumstances, to stop holes of the size mentioned in the bottom of a wooden vessel; and we may further remark, that the iron of which the frames and plates are made must have been of most excellent quality.

FAWCETT, PRESTON, and Co.
E. ROSS, engineer.
T. BAKER, engineer.
E. PARGETER, foreman boiler-maker.
N. FURLONG, engineer.
W. B. M'ALLISTER, foreman boiler-maker.

Liverpool, Sept. 2, 1847.

ARTIFICIAL MINERALS.

The experiments of M. Ebelmen, to produce minerals artificially, communicated to the Academy of Sciences, Paris, are thus given in *L'Institut*: the immediate subject being chiefly the varieties of the ruby.

"The method I adopted to crystallise these compounds, depended upon the property of boracic acid to dissolve all the metallic oxides, and upon the great volatility of this acid at a high temperature. I thought that by dissolving, in melted boracic acid, alumina and magnesia, mixed in the proportions that constitute the spinel, and by exposing this borate in open vessels to the high temperature of the porcelain kiln, the affinity of alumina for magnesia would determine the separation of a crystallised aluminate, and the complete expulsion of the boracic acid. In short, I employed boracic acid, at a high temperature, as water is used at ordinary temperatures, to obtain crystallised salts by evaporation alone. The proportions were about one part of melted boracic acid to two parts of alumina and magnesia, mixed synthetically to constitute the compound, $Al^2 O^3$, MgO; with the addition of a small quantity of the bi-chromate of potash. These materials, well mixed, were put on a platinum leaf, in a biscuit-cup, and exposed to the heat of a porcelain biscuit-kiln. I obtained a surface covered with crystalline facets, presenting in their interior reticulated cavities, the form of which was easily distinguished with the lens. These crystals were rose-coloured, transparent, readily scratching quartz, and presenting the form of regular octohedrons without any modification, They are quite infusible in the blow-pipe. These characters, joined to the composition of the crystals, synthetically ascertained, appear sufficiently conclusive to establish their identity with the spinel.

"By substituting for the magnesia its equivalent of the protoxide of manganese, a crystallised product is obtained in large laminæ, in the form of equilateral triangles, or of regular hexagons. These crystals, also, readily scratch quartz. I consider them to be the manganesiferous spinel $Al^2 O^3$ MnO, which has not yet been met with in the mineral kingdom.

"Oxide of cobalt, substituted for the magnesia, equivalent for equivalent, gave bluish black crystals, regular octohedrons. They again scratch quartz, but with more difficulty than the preceding."

In employing alumina and glucine in the proportions that constitute cymophane or chrysoberyl, $Al^2 O^3$ GlO, a bristling mass of crystalline asperities of great brilliancy is obtained. This product readily cuts quartz, and very cleanly topaz. It presents then a hardness comparable to the crystallised cymophane.

Certain silicates, infusible at the temperature of our furnaces, appear capable of being reproduced by the same process. Thus, in melting the elements of the emerald with half their weight of boracic acid, at the same temperature as in the preceding experiments, a substance is obtained, which easily scratches quartz, and the surface of which presents a great number of facets having the form of regular hexagons.

"I content myself," M. Ebelmen adds, in conclusion, "with submitting to-day these first indications, hoping, however, soon to present to the Academy a more detailed and more complete work. But I am convinced, at present, that it is possible to produce, at temperatures below those of our iron smelting furnaces, diaphanous crystals the hardness and external characters of which are analogous to those of precious stones. It is probable that in repeating these experiments in apparatus of certain dimensions, like reverberating furnaces, by operating on large quantities of materials, and continuing the application of heat sufficiently long, much larger crystals may be produced than those I have obtained, working with a few grammes only. Another conclusion to be drawn from the preceding facts is, that many species of minerals have the power to produce themselves and crystallise at temperatures much below those necessary to melt them."

Specimens of the products mentioned in the communication were submitted to the Academy.—*Literary Gazette.*

NOTES OF THE MONTH.

French Proof Engravings.—At a recent meeting of the Royal College of Chemistry, Prof. Taylor explained the manner in which French printsellers are enabled to increase the number of proof copies, to the great detriment of the purchasers. He showed that they had adopted the system of giving the paper a slight coating of carbonate of lead, which rendered the impression more perfect after the plate had become deteriorated; but that this was very soon converted into sulphide by the action of sulphuretted hydrogen constantly floating in the atmosphere of large towns, and by which interchange the print was destroyed. The presence of lead on this paper was showed by experiment. Prof. Taylor then stated that the brown colour of Valenciennes lace was due to a similar cause; the manufacturers sprinkling it with carbonate of lead, to make it look clear,—which being changed into sulphide on exposure to the air, gave the lace the dingy appearance so much prized by ladies.

Test for distinguishing Iron from Steel.—To distinguish iron from steel by a chemical process, take pure nitric acid, dilute it with so much water that it will only feebly act upon the blade of a common table knife. If a drop of the acid thus diluted be suffered to fall upon steel, and allowed to remain upon it for a few minutes, and then washed off with water, it will leave behind a black spot. But if a drop of this acid be suffered to act upon iron in the same manner, the spot will not be black, but of a whitish-grey colour. The black stain is owing to the conversion of the carbon of the steel into charcoal, which thus becomes predominant; and iron being nearly free from carbon, can produce only a grey stain. The utility of this test is not confined to finished articles manufactured of steel, but its application enables the workman in iron and steel to ascertain also the quantity and uniformity of texture of unfinished articles.

Sheathing for French Vessels.—The Minister of Marine has given orders that several experiments shall be made to test the quality of copper sheathing employed in England and France, for the coppering of vessels, as that at present used in the French Navy and merchant service soon corrodes, as has been proved by the recent report on the state of the bottoms of the steamers, frigates, and other ships of war, where French copper has been employed instead of British, as hitherto, and will have to be recoppered as soon as the superiority of the one over the other is fully proved. The copper manufactured in France is of a very soft nature, very corrosive, and but little adapted, either for marine purposes, boilers, or steam-engines, if not mixed with English metal.

Stagnant Water.—M. Fleurian de Bellevue states, as the result of his observations and inquiries on the effects arising from stagnant water, that in marsh lands which are covered with water to a considerable depth during the great heats of summer, the inhabitants of the localities in which they exist are not more unhealthy than in other localities; but that where the stagnant water is of slight depth the decomposition is attended with frightful consequences, and the mortality is great. He recommends that in all low lands where there is water during the summer of so slight a depth as to render decomposition certain, the inhabitants should form one

general reservoir into which the different masses of water may be conveyed by means of channels of communication.

Fusion of Mercury.—The result of M. Person's experiments on the congelation of mercury, and the latent heat of fusion, is that the heat requisite for the fusion of mercury is about eight times that required to change the temperature of water one degree. M. Person observes that the quantity of heat necessary for the fusion of metals is according to the order of their tenacity.

Steam Power.—It appears from a recent official return that the total number of steam engines in France in 1845 was 207; in 1840, it was only 109. Another return respecting the produce of the iron mines states that in 1845 the quantity of iron cast was 439,000 tons, whereas in 1825 the quantity was only 190,000. The price of bar iron, which in 1825 was 48f. the 100 kilogrammes, was in 1845 only 34f.

Removing useless Fences.—The following remarks are from a correspondent of the *Salisbury Journal*:—"I contend that thousands of sacks of corn may be grown annually in this country more than at present, were land-owners and tenant-farmers to turn their attention more than many of them do to the removal of useless fences. I am of opinion that many of the landowners have imbibed the notion that farmers are anxious to tear up their fences for the purpose of destroying game; but this is very far from being the greatest evil arising from having too many fences, hedgerows, &c. By allowing too many of these nuisances (for I know no better term for them) to remain on your farm, you not only lose the crop the land which they occupy would bear, but also the produce of several yards of land on each side of the same. One farmer has a field of 40 acres to get sown to wheat; another has the same quantity of land, but in four or five different fields. They both begin sowing on the same day, and follow the work till it is completed; and while the one is ploughing his headpieces, and turning about his horses so many times, the other completes the work; and the farmer who has his 40 acres in so many fields is a day and a half or two days later than the other. This is another very great advantage arising from having fields large. Some landlords will say, if they allow their tenants to break up so many of their fences, they shall have no cover for their game. I would say to every landowner throughout the kingdom, get your tenants out of the detestable practice, which many of them have got into, of sowing barley after wheat, or any sort of straw crop, in two succeeding years. Let them keep their farms well filled with turnips and every other sort of green crops, and this will make plenty of cover for game, and be the means of keeping the land in a fit state to sow corn on. I would again reiterate the cry throughout the land, 'Down with all unnecessary fences,' as it will ultimately prove a very great benefit to the landlord as well as the tenant. And where fences are really necessary on arable lands, let them be kept neatly shorn down, so that they may not shade the ground on either side, nor prove a harbour to sparrows, linnets, and many other destructive birds, which destroy annually in this country hundreds, and I think I should not be going too far if I were to say thousands, of sacks of corn."

Free Trade.—Among the importations from Antwerp lately, was a cargo of roofing tiles. This is understood to have been the first imported from abroad, and it appears to be the commencement of a new trade, as it is said there is another vessel on its way, and that a large quantity is still ready for shipment.

Irish Institute of Architects.—A deputation of the members of this body waited on his Excellency, the Lord Lieutenant of Ireland, headed by Sir Richard Morrison, with an address in which they deplore the condition of Irish architecture. His Excellency, in reply, said:—"It is not for me, gentlemen, to analyse the causes which may have led to the state of things of which you naturally complain, however strange it must appear to me that architecture should not be duly esteemed in Dublin, one of the most picturesque cities in her Majesty's dominions, and adorned as it is by so many noble public edifices, or in a country where such magnificent mansions exist, where genius is not rare, and taste and talent abound; but if happier days, as I venture to hope, are in store for Ireland, they must bring with them that encouragement of art and science which always marks a nation's progress, and they will strengthen a conviction, now on all sides manifesting itself, that the social condition of her people must be elevated. Towards carrying out this pressing and national object, the Royal Institute of the architects of Ireland may, as it seems to me, powerfully co-operate; for when it is considered how much requires to be done towards the improvement of towns, and thereby ameliorating the sanitary condition of the people, and how little care has hitherto been bestowed upon the dwellings of the humbler classes of our fellow subjects, that the places of religious worship, schools, hospitals, and asylums, are insufficient for the wants of the country, a wide sphere of usefulness is manifestly open to a scientific and practical body such as yours; and I feel sure that the architects of Ireland, like the most eminent men of their profession in every country, will at all times be found ready and anxious to aid the great work of social improvement."

Military Cemetery.—It is stated that the Duke of Wellington, as Commander-in-Chief, has given his sanction to the formation of a grand cemetery and mausoleum on Shooter's Hill, for the officers of the British army and navy, as well as those in the East India Company's Service. The mausoleum will rise in the centre of the ground, on the spot where Seven-droog Castle now stands. It is to be raised in a series of terraces—the substruction of which will afford space for ten thousand catacombs.

Great Nassau Tunnel.—The great tunnel through the mountain on which stands the town of Weilburg, in the Duchy of Nassau, formed for improving the bed of the Lahn, has just been terminated after five years' continuous labour. The waters of the Lahn were to be let into the tunnel on the 12th, and 2,000 gas lamps were to be lighted, and always kept burning. The formal inauguration of the gigantic work is to take place on Oct. 15.

The Fortifications of Sheerness, says the *Kent Observer*, are fast approaching completion. With the exception of a few yards towards the sea the whole line is finished, the gun-carriages fixed, all the smaller guns mounted, and several of the larger ones are to be seen peeping over the parapet. Last week excavations were commenced in the open space opposite the dockyard chapel, preparatory to laying the foundation for an extensive range of barracks, and the road between Mile Town and Blue Town has been closed for five or six weeks past, a temporary road having been made round by the beach, whilst two new drawbridges, with bastions and other defences, are being constructed.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM SEPTEMBER 2, TO SEPTEMBER 23, 1847.

Six Months allowed for Enrolment, unless otherwise expressed.

Henry Davy, of Ottery, St. Mary, Devon, gentleman, for "Improvements for separating copper and other metals from their ores."—Sealed September 2.

Robert Oxland, of Plymouth, chemist, for "Improvements in dyeing, parts of which improvements are applicable to the manufacture of metallic alloys."—Sept. 2.

Richard Madigan, of Haverstock-Hill, Middlesex, civil engineer, for "Improvements in railway turn tables."—Sept. 2.

Charles Chabot, of Skinner-street, Snow-hill, City, zincographer and engraver, for "Improvements in railway carriages, and in the buffers and other apparatus connected with such carriages."—September 2.

Sykes Ward, of Leeds, for "Improvements in communicating motive power which are applicable to working of breaks on railways; and also improvements in communicating intelligence signals and motive power by the agency of voltaic agency."—Sept. 2.

Thomas Foster, of Streatham, Surrey, manufacturer, for "Improvements in machinery for cutting india-rubber, in rendering fabrics waterproof, and in making articles from fabrics so rendered, waterproof, and in dissolving india-rubber and other gums."—September 2.

John Mitchell Rose, of the firm of Rudall and Rose, of Tavistock-street, Covent-garden, musical instrument makers, for "certain Improvements in flutes, clarionets, and other similar wind-instruments." (A communication.)—September 6.

Henry Vint, of St. Mary's Lodge, Colchester, gentleman, for "Improvements in propelling ships, and other vessels."—September 6.

John Barke Gustavus Ferryman, of Cheltenham, gentleman, for "certain Improvements in handles to be applied to various articles for containing liquids or other matters liable to be spilt."—September 6.

James Leadbetter, of Over Darwen, in the county of Lancaster, brazier, and William Pierce, of the same place, mechanic, for "certain Improvements in machinery or apparatus for raising water and other fluids."—September 6.

Thomas Marsden, of Salford, in the county of Lancaster, machine-maker, for "Improvements in machinery for dressing or combing flax, wool, and other fibrous substances."—September 6.

Joseph Clinton Robertson, of Fleet-street, London, for "certain Improvements in the manufacture of metals from their ores." (A communication.)—September 9.

James Sims, of Redruth, in the county of Cornwall, civil engineer, for "certain Improvements in steam-engines."—September 9.

William Gibbons, of Corbyn's Hall, near Dudley, Worcester, for "certain Improvements in trussing beams and girders."—September 9.

Thomas Battye, Woburn-place, Middlesex, gentleman, for "an Improved mode of retaining the waist of the human body in a desirable form, without producing the inconvenience resulting from too tight-lacing of stays or corsets, or buckling of belts, waistbands, or girdles."—September 9.

John Blyth, and Alfred Blyth, both of St. Ann's, Limehouse, engineers, and John M'Culloch, of Masemore-cottages, Old Kent Road, Surrey, chemist, for "certain Improvements in apparatus for distilling and rectifying."—September 9.

Frederick Steiner, of Hyndburn-cottage, Lancaster, for "Improvements in the manufacture of sugar."—September 9.

Connor William O'Leary, of Tralee, in the county of Kerry, Ireland, for "certain Improvements in the methods of producing power for the discharge of weapons and missiles, and other purposes."—September 9.

William Brockeden, of Devonshire-street, Queen's Square, for "Improvements in heating rooms or apartments."—September 9.

Clarence Augustus Kurtz, of Manchester, for "certain Improvements in the mode of preparing and using indigo in the dyeing and printing of woollen, cotton, and other fabrics."—September 9.

James Pitt, of Cheyne-walk, Chelsea, gentleman, for "Improvements in apparatus for holding down trowsers."—September 9.

David Morgan, of Morriston, in the county of Glamorgan, coppersmith, and John Borlax Jenkins, of Middle Bank, same county, copper agent, for "certain Improvements in the manufacture of copper and other metal cylinders or rollers for the printing of silks and other fabrics, and for other similar purposes, and in casting copper and other metal cylinders, tubes, or rollers, hollow and free from air bubbles."—September 9.

William Hancock, of Pentonville, gentleman, for "certain Improvements in bolts, locks, and other fastenings."—September 16.

George Bell, of the city of Dublin, merchant, for "Improvements in gas tar, by means of which improvements it may be used as a substitute for oil paint, which he intends to designate as patent mineral paint."—September 23.

John Dickinson, of 65, Old Bailey, stationer, for "certain Improvements in the manufacture of paper."—September 23.

Arthur Harry Johnson, of Gresham-street, city, assayer, for "Improvements in refining silver lead by effecting a saving in one of the materials used."—September 23.

Henry Newton, of Lisson Mill, Derby, cotton-spinner, for "Improvements in spinning and doubling cotton and other fibrous substances."—September 23.

THE MUSEUM OF ECONOMIC GEOLOGY.

(With Two Elevations, Plate XVII.)

That species of astylar composition which is now generally qualified as the Italian "palazzo" mode, admits of very great variety and freedom of design, and of no less diversity of character in regard to the degree of finish and decoration bestowed upon it; which latter may be carried if required to the point of the most intense richness. Unfortunately, however, variety of design in regard to minor features and detail,—which constitutes almost the only species of variety a mere *plane* street façade admits of,—seems rather to have been shunned than aimed at; it has been so either without due study or else too timidly. The new Museum we are now noticing has, therefore, caused us somewhat of an agreeable surprise, there being much in it that is quite out of the beaten track. In one respect, it certainly performs more than was to be looked for, since it gives us two totally distinct pieces of architecture, its two façades contributing a very marked architectural feature to separate streets—viz., to both Jermyn-street and Piccadilly. That neither front bespeaks the actual purpose of the building at all distinctly must be admitted, for there is more of Club-house physiognomy, especially in the Jermyn-street front, than of what expresses such a public institution as a Museum. It will besides be objected perhaps by some, that the Piccadilly front is defective as a front, there being there neither entrance nor the appearance of any, but the entrance must be sought for in another and far less public street. Another circumstance, which, if not exactly a fault, is not in accordance with the laws of composition for what shows itself as a distinct façade, is that the Piccadilly front having an even number of apertures (six) on a floor, presents no central feature. Still there is merit enough to counterbalance, or more than counterbalance, what only very rigorous criticism indeed is likely to take exception to.

To begin with the Jermyn-street front, as the entrance one, although the design consists of what seem, when described in words alone, very commonplace features and arrangement, it exhibits a far greater than usual degree of artistic treatment. In fact, the door, or we should term it portal, is almost an unique example here,—noble and even imposing for its amplitude, and though simple in its general composition, singularly rich in design. An example of the kind was much wanted among us, the entrance doorways and doors, even in our principal public buildings, being, if not all of them exactly insignificant, deficient in grandeur. Even the best of our club-houses are not distinguished by any excellence in regard to such feature; in some of them, on the contrary, the entrance doors are altogether of the most ordinary character. Mr. Pennethorne, then, has taken an equally decided and happy step forwards in astylar composition, by making his door the focus of it as it were,—the principal feature in it of all, on which the eye rests with contentment and satisfaction, it finding there sufficient to interest and detain it. In addition to richness of the architectural dressing, the doors themselves will be decorated by elaborately carved panelling; wherefore we purpose showing them and the doorway, together with some other details, drawn on a larger scale. The opening of the door measures 6 feet 6 inches, by 16 feet high, and the entire composition 11 feet by 23 feet, which proportions are as remarkable as the dimensions are unusual,—that is, except in one or two buildings where a single large doorway, or else a central one accompanied by two lesser ones, is placed within a portico or other columnar composition. There is, as far as we are aware, but one other astylar façade which is at all remarkable for the importance given to the door, namely, the Hall of Commerce, in Threadneedle-street, unless the large door in the west front of the Bank may also be quoted as an instance; although with regard to the latter, it should be observed, it belongs to what, if in that part of it it may be termed astylar piece of architecture, is not a fenestrated one. Both those examples, however, are of very plain design, more especially with regard to the doors themselves. Exquisite taste of embellishment, together with perfect completeness of decoration, is to be found in the doors within the portico of St. Pancras' Church, which ought to have led not, indeed, to direct imitation—and they themselves are only direct imitations—but to similar laudable ambition on other occasions.

Perhaps it will be thought that we dwell, if not too long, too exclusively upon that single feature in the Jermyn-street front of the building; yet hardly can its value be too forcibly insisted upon, more especially as there is nothing in the mere name of "door," as in that of "portico," to characterise or appear to characterise a design when merely spoken of. Yet we would readily give half-a-dozen of our usual Doric or Ionic porticoes for one such a portal as that we are noticing. It gives a decided physiognomy to the whole façade; which, if that were taken away, becomes comparatively tame and uninteresting. This last remark may seem to imply something like an unfavourable opinion as to the general design, taken independently of that single feature. Yet it ought not to do so, seeing how many buildings we have whose sole merit—or we should rather say whose architectural pretension altogether—consists in its having a few columns put up against it for a portico, and without which there would frequently be nothing whatever at all answering to even the most ordinary notions of design. There are, besides, many Gothic buildings whose fronts would be almost vacant and featureless were it not for a doorway or portal which imparts interest, and sometimes a very peculiar and piquant charm to the whole. For making this observation we are not to be understood as intending to insinuate that it so far holds good here, that, with the exception of the door, the other features possess very little value or interest. Many of them, on the contrary, afford evidence of laudable study of detail, and highly commendable attention to those minuter but not least precious touches in design, which bespeak the artist.

The Piccadilly façade—but no, we will reserve that till our next number, when we hope to be able to enter into some description of the designs for the interior also.

HISTORY OF ARCHITECTURE IN GREAT BRITAIN.

A Brief Sketch or Epitome of the Rise and Progress of Architecture in Great Britain. By JAMES ELMES.

"Epitomes are helpful to the memory, and of good private use."
SIR HENRY WOTTON.

(Continued from page 302.)

About the same time that James Wyatt flourished under the patronage of George III. and the leading aristocracy of England, the leash of architectural brothers, the Adelphi Adams, arose and took their ground on the architectural battle-field, with distinguished success. They have recorded their relationship in the Anglo-Hellenic term of the Adelphi buildings, between the Strand and the Thames; and their names by Robert, James, John, and Adam streets, Adelphi. One of these, the author and delineator of "Dioclesian's Palace at Spalatro," had travelled to, and enriched his country's literature by his description of that once gorgeous assemblage of architecture, sculpture, and painting. Like Wyatt, he endeavoured to introduce a new style, but it was not derived from so pure a source. Neither of these able men were imbued with so manly a taste as Jones, Wren, Lord Burlington, and Kent; the latter of whom has been before noticed in connection, as an artist, draughtsman and painter, with Lord Burlington. In fact, he was not solely an architect, but the able and not always tasteful assistant to his noble patron. As a painter, he may be classed with the Verrio, La Guerre, Thornhill, and Kneller schools. He was considered a man of taste, was an able landscape gardener, and was much consulted as such by the nobility and gentry of his time. As editor of Jones's architectural works, and joint editor with Ripley and Ware of "Sir Robert Walpole's seat at Houghton, in Norfolk," he showed great industry and talent, particularly in the correct way in which he delineated the ornamental details. From his intimacy with Lord Burlington and other distinguished men, he was often consulted by the fashionable world upon affairs of art; and is said to have sent a lady to court in a brocaded silk dress of his design, upon which were wrought temples, statues, fountains, triumphal arches, in all the glories of the five orders of architecture; making the lady a walking Palladio in petticoats, and her hooped rotunda a veritable temple of the Cytherean goddess. He was also occasionally employed as an illustrator of books, among which was Tonson's edition of "Gay's Fables." In these his professional knowledge is shown to advantage in his interior of the theatre which forms the head-piece to the fable of the two monkeys; who, gravely seated in one of the stage boxes, are criticising the efforts of the rope-dancer on the stage to imitate their agility, asking—

"How can these clumsy things, like me,
Fly with a bound from tree to tree?"

The interior of the library wherein are the learned elephant and the book-

seller, the sick man's chamber, and the court of Death, exhibit his architectural knowledge; whilst the decorated gardens in which are the poet and the rose (said to be a portrait of Gay), and the gardener and the hog, show him as a designer of gardens.

Wyatt, as before remarked, was an architect; so was originally Robert Adam; but the firm of "Adam brothers" were speculative builders. The district called by them the Adelphi, is the greatest of their works in this department; and their overgrown speculations in Edinburgh left the modern Athens for many years almost as much a heap of architectural ruins as was its ancient namesake.

The style of architecture aimed at by the brothers in their Adelphi buildings was the pseudo-Grecian used in the decline of art by the emperor Dioclesian and his artists. The great difference of level between the high street of the Strand and the left bank of the Thames, upon which they erected these buildings, was filled up by a range of warehouses and wharfs covered by arches, which formed the basement of the terrace and dwelling houses above. The range of houses built upon the terrace facing the Thames is planned with great skill for domestic use and comfort.* So are the two streets at the eastern and western extremities, which form detached wings and connect the series of dwellings into a whole as a composition. The street which runs from east to west on the northern side of the main building, and carried on by a range of similar design into the Strand, contains the mansion, museum, and great room belonging to the Society for the Encouragement of Arts, Manufactures, and Commerce, and some houses of a larger size than those which face the river, used as private hotels, offices, and chambers for professional men. The leading decorations are a series of very narrow pilasters between the windows, supporting cornices of no precise order, but all profusely enriched with foliage and arabesques in low relief, of the Dioclesian style. The most striking defect of this design, considered as an architectural composition, is a lack of boldness in projection and recession, which causes an uninteresting flatness, for want of a due proportion of light and shade, that mars the whole design. The projections of the pilasters are too small, and the reveals of the windows too shallow, to produce that artist-like effect which could alone give its author the name of architect. The whole mass bears more the appearance of a building speculation than the work of an architect who sought for an enduring name. These defects are the more to be lamented, as they occupy the finest situation on the north bank of the metropolitan part of the Thames. The buildings not only appear fragile, but are actually so, and exhibit many symptoms not only of decay, but of unscientific construction and ill-selected materials. The plain and ornamental stucco work that embellished the exterior of these houses, formed of lime mixed with oil (the original of Hamelin's mastic), dignified by royal letters patent and the sounding name of Adam's cement, has failed in many places, and been replaced by plain pilasters, unornamented capitals, and flat surfaces of Roman cement. The endeavour to give an architectural character to the shop fronts, by substituting termini, busts, and semi-caryatides, instead of the common stall-board and story-posts of their London predecessors, not only deserves praise, but followers.

The south front of the edifice belonging to the Society for the Encouragement of Arts, &c., is in a more manly and architectural style than any other on the Adelphi estate. The principal or one-pair story consists of a tetrastyle attached portico of three-quarter columns, supported by an appropriate ground story. The columns are of the Ionic order, rather too slender in proportion for the intermediate character of the order, which should bear a just medium between the robust Doric and the delicate Corinthian. They support an entablature and pediment, which being carried into the two flat wings of the adjoining portions of the building, possess no artistical meaning, and are a mere ornamental appendage stuck on to the plain front of a large house consisting of windows and piers only.

Brother Robert designed and executed many buildings of a similar character in Scotland, and published a volume illustrative of their details in 1764; and also a folio volume, marked with industry, pains-taking research, and graphic correctness, of the ruins of Dioclesian's palace at Spalatro. He was patronised by the Earl of Bute, through whose influence he was appointed architect to the king for Scotland; and was for some time superintendent of the works at the Royal-hospital, Greenwich, and erected a pavilion in the Dioclesian style at each end of the terrace, one inscribed with the name of George III., and the other Queen Charlotte.

The brothers Robert and James published their joint architectural works in three volumes folio, of which the first two were published in 1764, and the third in 1822. Of brother John we have no literary records but that of his name at the corner of one of his streets in the Adelphi.

Among the best works of the Adams in the metropolis are a mansion in the north-west corner of St. James's-square, much resembling the stuck-on pseudo portico of the Society of Arts; Lansdowne-house, on the south side of Berkeley-square, a large and commodious mansion with a body and two wings, the former decorated with the same lank and meagre attached columns of the Ionic order that disfigure all the works of the Adams. The spacious court-yard in front left ample room for a real portico, but they did not avail themselves of the opportunity. This mansion was celebrated in the lifetime of the late marquis, by whom it was built, for that collection of ancient statues, busts, and reliefs, known by the name of Lansdowne marbles. The Royal Academy, about fifty years ago, thought the principal elevation of this structure to be of sufficient importance to form a study for its architectural students, and gave a silver medal for the best geometrical elevation, tinted and shaded, with a duplicate in outline, correctly finished from actual measurement. The Adams also erected the street-front of Drapers'-hall, in Throgmorton-street; some well-built houses opposite, whose interiors bear marks of a better architectural character than most others of their period; and the street-front of Skinners'-hall, on Dowgate-hill, in the City, marked by a similar tameness of character as the before-mentioned works in the Adelphi.

If the Adams left no followers of their vitiated Spalatro style of decoration, they have been followed in their pseudo-Greek, which, like the lady Anglo-Gallic of the circulating libraries, has invaded our national cockneyisms. Some learned Thebans at Waterford, who built a large warehouse-like row of houses on the right bank of the beautiful river Suir, have named it, after the mode of the Adams, the *Adelphi*-terrace; so also did two comedians, who agreed like anything but brothers, alter the name of the Sanspareil to that of the *Adelphi* theatre; and a widow, not to be outdone in Greek by her neighbours, named her stall the *Adelphi* oyster-rooms; and a classical gin-shop on the other side has assumed the name of the *Adelphi* wine-vaults, by an only brother.

James Stuart, who received the honourable addition of "Athenian" prefixed to his name, returned to England about the time that the Adams were flourishing in Dioclesian glory. This eminent man was more of an artist than a practical architect, although he delineated the geometrical details of the art with mathematical precision, and drew the human figure and sculptural embellishments with correctness and taste.

The first accurate knowledge which the people of Europe received of the Athenian antiquities was given by the publication of Dr. Spon and Sir George Wheler, who both fortunately travelled before the Venetian siege. Travels and descriptions of that part of Greece afterwards became more numerous and more sought for. In 1751 Stuart, assisted by Pars, a painter, and Revett, an excellent geometrician, employed three years in measuring and delineating the principal antiquities in Athens and its vicinity. In 1764 the London Dilettanti Society commissioned Dr. Chandler, a learned and investigating man, to examine and report upon these unedited antiquities. Le Roi, a French artist of some ability, visited Athens about the same time as Stuart, and foisted erroneous accounts and delineations of them upon the public.

The drawings and delineations of Stuart and his companions soon became known among the higher and learned classes of England, who duly appreciated the high taste of refinement and purity exhibited in this grand style of art, now known to them for the first time. Preparations were made for their publication with such rapidity, the progress of which was much assisted by the perfect state in which these artists brought over the drawings, that in 1768 they were presented to the public under the title of "The Antiquities of Athens, measured and delineated, by James Stuart, F.R.S., F.S.A, and Nicholas Revett, painters and architects," 4 vols. fol. 1768.

On the occurrence of a vacancy he was appointed by George III. to the office of architect and surveyor of buildings to Greenwich-hospital, which afforded a comfortable leisure to the industrious Athenian traveller. During the time of his holding this office, the chapel and a great part of its bell-tower were consumed by fire, and Stuart designed and superintended their restoration. The whole of its exterior he rebuilt, with due regard to the honoured name of Wren, precisely in the manner in which that great architect left them; but the interior he remodelled after the Athenian style, which is scarcely so suitable for such an interior as was the bolder and more decided style of Wren. It is, however, to be admired as the first actual execution of Attic detail in England, as well as for the chastened purity which pervades the whole design. Benjamin West, then a young

* This terrace is celebrated as being selected by Garrick as a residence wherein to pass the evening of his days. On an occasional visit, Foote asked him whether he had a yard behind his house, the tragedian replied, "I do not know, but I will measure," and on his return said, "I have not, for it is only two feet eleven inches."

man, whose powers as an historical painter were soon perceived by the king, painted a large picture for its altar-piece; the subject selected by his majesty was St. Paul's escape after his shipwreck on the island of Malta, and his miraculous shaking off the viper that had fastened upon his hand, without injury. This picture is generally esteemed to be one of West's master-pieces; another being the stoning of St. Stephen in Wren's neglected gem of art, the church of St. Stephen, Walbrook. The chapel of Greenwich-hospital also shows West to advantage as a sculptor, in some low reliefs of the history of St. Paul in the panels of the pulpit.

No event that ever occurred in the history of architecture in England, and thence throughout all Europe, produced so sudden, decided, and beneficial an effect as did the works of James Stuart. It surprised and delighted the learned and admirers of art; the majestic grandeur and simplicity of form exhibited in the general outline of its beautiful temples, and the exquisite purity and elegance of detail shown in all the profiles of his mouldings, fascinated the eye of taste. The natural form, in which everything was subservient to utility, proved how pure was the taste of the elegant Athenians. Nor did the contrast between the works of these ancient architects and their successors and self-called followers strike the mind with less force. Unlike the Romans, there were no pediments under pediments, or under porticoes, or in the interior of buildings,—to which absurdities the Romans were so partial, as to draw down the rebuke of Cicero, that his countrymen were so fond of pediments, that if they had to erect a temple in Olympus to the "Jupiter Impluvius," they would cover it with a roof and decorate it with pediments.

Nor was the contrast greater in the details of their mouldings; those of the Romans being all subservient to the circle and its parts, whilst those of the Greeks defied the mechanical slavery of the carpenter's compasses. Ellipses, parabolas, and other elegant sections of the cone, are the elements of all their curves, and their Ionic volutes bid proud defiance to the compasses of Batty Langley and the ingenious mode of striking the Ionic volute invented by those eminent Italian architects, Scamozzi, Vignola, and Andrea Palladio. Let the eye of taste decide between the echinus of Athenian architecture and the ovolo of the Roman; the cymatium of the Greek and the ogee (what a name!) of the Roman; the bold, manly, and elegant curvature, amenable to no compasses but those which the artist carries in his eye, of that type of the Ionic order in the temple on the Ilissus, or the more beautiful complicated sweeps that form the elegant curvatures of those of Minerva Polias, one of which is in the British Museum, with any Roman or Italian example that ever existed in type or in book, from Vitruvius to Borromini.

It has been the fashion of late with certain sciolists to decry Greek architecture as a heresy, a mere ephemeral fashion, a style of bygone times not worth reviving; and among others, calling themselves architects, that it is good for its remote antiquity, but has been greatly improved by the Romans and Italians. Have we not, say they, added two orders, the Tuscan and the Composite, to the original three? Fluted and cabled and pearled and olived and bedizened the Corinthian, making it as fine as a May-day queen? Angularized or Scamozzied the volutes, lengthened the shafts, bolstered the frieze like the side of a Dutch cheese, and modillionized its cornice, that Ictinus would not know his own invention; added ogees and annulets and colarinos to the unfinished capital of Minerva Parthenon; and a handsome base to its shaft, like a buckled shoe to a naked foot,—and call you not these improvements and additions to the bald Greek style?—Bald it is, indeed, as used by some of modern times; making a miniature model of the majestic temple of Minerva an entrance stuck upon the flank of a huge dead wall, or,

"To what vile uses may we come, Horatio,"

to serve as the passage to a stinking stable-yard. To transform the beautiful style of the temple of Bacchus at Teos—the god who rivalled Apollo in youth and beauty, and shared with him the attentions of the muses and the graces—to the embellishments of gourmandising eating-houses, or to the still more debased temples of intemperance, the Bacchus of the gin-shop; the god to whom Gay in his fable of the "Court of Death," gave the wand of pre-eminence before all his other faithful subjects, saying emphatically,

"He shares their mirth, their social joys,
And as a courted guest, destroys;
The charge on him must justly fall,
Who finds employment for you all."

Fuseli, on being asked whether there was not much breadth of style in one of these Anglo-Greco plagiaries, replied, "that if baldness was breadth, it was broad enough in all conscience."

See, say the Romanists to the Grecians, how gaily we have dressed your naked Venus—how nobly we have attired your slim Apollo—how we have fed and fructified your barren Teïan god?—You have, indeed, sighs a venerable Greek, clothed the Venus of Praxiteles with a head-dress of wool and powder, like Ramsay's portrait of good Queen Charlotte; given her a boddice, hoop, and farthingale, with high-heeled pointed-toed shoes, like Bird's statue of Queen Anne in St. Paul's churchyard; transformed the Hyperean curls of the Delphic god into a periwig of George the Second; cut and concealed the rest of the manly beauties of the son of Latona in attire, like one of Hogarth's coxcombs; and fructified the Grecian Bacchus into a genuine city Silenus, bursting with dropsy, gout, and apoplexy.

Greek art may be reviled, but let its revilers equal it if they can,—to surpass it is beyond their powers: hence the cause why they traduce what they cannot understand. Samuel Johnson, on finding a Greek quotation amidst some modern trash, like "a green Oasis in a desert world," exclaimed, "So much Greek, so much gold." So does the man of true taste on viewing the architecture and sculpture of the godlike Greeks.

About the same period with Chambers, Wyatt, and the Adams, flourished other architectural stars of lesser brilliancy. Ware, who assisted Kent and Ripley in the delineations of Walpole's mansion at Houghton, and known by his ponderous folio, "A Complete Body of Architecture," published in 1768,—as bulky and as little read as the statutes at large in an alderman's library. Brettingham, the architect of Holkham, in Norfolk, the plans, elevations, and sections of which, together with a description of the statues, pictures, and drawings, he published in a folio volume in 1773. He also designed and executed the handsome mansion near the south-west angle of St. James's-square, London, now the town residence of the Bishops of Winchester; and a few other works of less importance, but none marked by any distinctive character.

Among the architectural publications of this period, useful alike to the student and amateur, may be enumerated the works of the collected designs of Inigo Jones, Palladio, Scamozzi, Perrault, &c., by Kent, Lord Burlington, Leoni, James, and Ware, which were, however, for a time swallowed up by the magic wand of Stuart, as that of Moses did those of the Egyptians before Pharoah.

James also flourished about this period, and is best known to architectural critics by his Hawksmoorian churches of Greenwich and Deptford; the former of which was judiciously selected, a few years since, by the Royal Academy, as an architectural competition for its silver medal students.

Paine also enjoyed a portion of the royal and noble patronage of the country in the same era; he built the pretty bridge over the Thames at Richmond, and made some pleasing additions, in the Elizabethan style, to his own residence at Addlestone, near Chertsey, Surrey, which was for many years the hospitable residence of the late Sir Charles Wetherell, of legal and facetious memory. Paine was one of the attached surveyors of the crown in the Land-revenue department, and had considerable practice as an architect among the nobility. None of his works, however, entitle him to the name of a master in his art, nor have distinguished him from the herd of servile imitators of the Italian school. The plans are all well arranged and commodious, sound in construction, and well built; but as meagre in originality of style as the most servile copyist of the common-place school to which he belonged. He did that which it would be well if better architects would imitate—namely, published his works; one entitled "Plans, Elevations, and Sections of Noblemen's and Gentlemen's Houses, &c. &c., executed in various parts of England," 2 vols. folio, 1767, 1783; and the other, "Plans, Elevations, Sections, and Ornaments of the Mansion-House of Doncaster," folio, 1751.

The early part of the reign of George III., so prolific in works on art, produced Cameron's elaborate treatise, "On the Baths of the Romans," in which he successfully explained and improved the "Restorations" of Palladio. It was published in 1772. Colin Campbell also published his very useful work, the "Vitruvius Britannicus," in four consecutive volumes, between the years 1715 and 1771; to which Woolf and Gandon respectively added supplementary volumes, of equal skill and correctness. More recently, Richardson added another volume, so much inferior to its predecessors, that the work was discontinued.

The latter part of this fertile period produced Robert Milne, a pupil, I believe, of Robert Adam; at all events, he was of the same country and school. Like Wren, he exhibited precocious talents; for scarcely at the age of manhood, he triumphantly bore away the first prize in the first class of architecture at Rome, and had the honour of being the first Briton who obtained a premium for art in that city. He was not only a Protestant—and consequently a heretic, in the estimation of the professors of the primitive faith—but was also of that anti-Papistical sect, a Scotch Calvinist. The

superabundant ceremonials of the church of Rome which he witnessed in this very heart of popery, the profligate manners and lives of its professors, and the unceremonious style of worship of his own church, perhaps led to that contempt which Milne always impatiently exhibited, even at the decent ceremonies and more simple garb of the church of England. Before he had completed his studies in Rome, he sent over in competition, and conquered all his opponents, for his Blackfriars'-bridge, a work of skill and some originality. Milne's style was too decidedly Roman for the day; but, to his honour be it spoken, his love and affection for our great metropolitan structure, St. Paul's, of which he long held the place of surveyor, was such, that he never would see it defaced or altered, or spoiled in any way; and scarcely a week of his long life passed without him giving it a personal survey.

Milne never did anything better than his Roman design, which was in every way worthy of one of the best disciples of one of the best architectural schools the world has ever produced. It formed a becoming ornament of his study or *sanctum sanctorum*, at his residence at the New River head, Clerkenwell. I have often admired it in my youthful days, with its Italian inscription—"*Primo premio Roberto Milne, Scozzese, Roma*," with its date and something else which I have forgotten, or perhaps never understood,—Italian being in those days as great a stumbling-block to me as St. Paul's doctrine was to the Greeks; and I feared even to ask this architectural Aristarchus anything more than the mere subject before us. He was a man of austere manners, of violent temper, and appeared to have a contempt for every art but his own and for every person but himself. In some of his ebullitions of temper, he has been known to kick the clothes and tools of workmen, who have dared to reply to him, out of windows and into holes in the streets, and has been obliged to fly from the effects of their excited wrath. One of these, an Irishman, said that "Mr. Millen," as he called him, "was a rale jintleman, but as hot as pepper and as proud as *a* Lucifer." Peace be to his remains, which quietly repose by the side of his great predecessor, in that noble cathedral which was built by the one and sustained by the other.

This architect is not known for many other works than his Blackfriars'-bridge; a few bridges, and perhaps one or two mansions, in Scotland; the buildings and machinery of the New River company; and a very commonplace elevation to the east front of Stationers'-hall, Ludgate-hill. The principal employment of his latter years was that of architectural curator to St. Paul's cathedral, architect and surveyor of buildings to the Stationers' company, and engineer to the New River company; dividing his time between his two official residences at either end of that river—its spring or source at Amwell, near Ware, in Hertfordshire, and its other end at Clerkenwell, erroneously called the New River head,—it being the reservoir which supplies, by steam machinery, such parts of the metropolis that are served by the company.

Sir Robert Taylor, a man of great capacity, occupied a distinguished station in Tertio-Georgian era. He was one of the chief architects to the crown, and architect to that opulent body the Governor and Company of the Bank of England, when it began to expand its buildings to the right and to the left of that comparatively small edifice which was more than adequate to its necessities on its establishment in the reign of William III. He had much private practice, and was known for three-fourths of a century to every architect, surveyor, builder, and lawyer in the metropolis, for his celebrated, incomprehensible, and contradictory Building Act, which is only surpassed in litigious absurdities by its successor. He educated many pupils, to whom he gave either districts under the Building Act, or appointments in the office of the Board of Works. It is true, that none of them proved to be men of taste; but they were all thoroughly men of business, high honour, and ntegrity. It is probable that he intended his son to be a great artist, for he gave him the powerful name of Michael Angelo; as did another more recent architect name his scion Christopher Wren. Poor little Christopher, however, died young, and destroyed all hopes of his rivalling his namesake: but Michael Angelo Taylor lived to be a respectable whig member of parliament —the best tempered whig that perhaps ever lived, and the giver of the best dinners that ever did honour to Spring-gardens.

The style of Sir Robert Taylor was founded upon the best Roman examples, resembling in its finest points those of his cotemporary, Sir William Chambers; but he far excelled him in scientific construction and sound building. He found a pretty design for a tetrastyle portico and pediment, with lateral columns of a very elegantly-proportioned Corinthian order raised upon pedestals, in Chambers's work on "Civil Architecture," confessedly borrowed from an anonymous Italian architect. These he repeated on either side of the coarse Ionic centre of the Bank of England in a very pretty but unconnected manner. The whole of this front, which extended from the corner of Princes-street to Bartholomew-lane, has been replaced by the massive and masterly composition of Soane, of which more will be said hereafter. In another part of this building is a quadrangle on the western side, which is still preserved in almost its original freshness, a very choice example of Taylor's skilful adaptation of this tasteful precedent of the Corinthian order. In the centre is a pleasant city garden, with a few verdant lime trees that give variety to the picture. The former façade, next Threadneedle street, being a screen wall to the internal edifices, had no apertures, and was more a copy from Chambers's work than the one in question; which, being an interior court, and giving light to the directors' parlour and other important rooms in that edifice, is decorated by a series of exquisitely-proportioned Venetian windows, which adds a charm to the composition that the original design is much in want of. There is not an executed building of the decorative Greco-Romano style in Europe, that more deserves the titles of tasteful and elegant than does this pretty composition of Sir Robert Taylor.

The two islands of houses that stood between Threadneedle-street and Cornhill, called Bank-buildings, that were taken down to make way for the Royal Exchange and the open area on its western front, and which were occupied by some banking-houses and insurance companies, were a masterpiece of street architecture, putting situation aside, not surpassed by any in Europe. Upon a massive stylovate, that gave height and light to the basement stories, was raised an attached colonnade of as elegant a Roman-Doric as ever emanated from the pencil of a modern architect. The intercolumniations were filled with doors and windows as necessity and internal convenience required, deeply recessed and with bold reveals that served for every purpose of office or shop. The upper part consisted of a lofty elevation of well-proportioned windows with architectural stone dressings, with that breadth between them which characterise all this architect's works. This peculiar characteristic is particularly noticeable in the lofty mansion on the western side of Tower-hill, in which the proportions of the windows show the loftiness of the stories within. This character, which gives such harmony and grandeur to the elevations of Sir Robert Taylor, was so perplexing to the architect (?) of Phillimore-place, Kensington, that he filled the interval between the one and two-pair stories windows with little panels, which, if left open, might have intimated that they were windows to that bungling Italian contrivance, a mezzanine story; but which he rather chose to fill with ornaments (!) of sculptured swags, representing wet cloths hung upon pegs;—he would doubtlessly have filled Sir Robert's broad spaces with similar imitations. King George the Third, who often passed through Kensington in his route from London to Windsor, named that specimen of Kensingtonian architecture, Dishclout-row.

Another fine specimen of Sir Robert's tasteful design is almost lost in the narrow but wealthy way of Lombard-street. It was originally erected for a banking-house, but is now occupied by the Pelican Life Assurance company, and is situated on the north side of the street, nearly opposite Abchurch-lane. The basement story is formed of a solid stylovate, which serves for a base to the Doric order of the lofty ground story. It is of the same classical Roman-Doric that he used in the Bank-buildings. The one-pair story is lighted by three well-proportioned semicircular-headed windows; and above, a row of attic windows, at such a distance from those below them as would have induced the Kensington architect to have hung out his flags of distress. Every admirer of architecture should take a view of this excellent design, before the genius of wide streets takes it away. The well designed group of sculpture by De Veare, which designates the nature of the office, and disfigures the design, must not be taken into consideration in the estimation of the architectural beauties of the edifice, to which it does not belong, and can only be considered as a good thing ill applied.

A smaller, but not less tasteful, example of this architect's peculiar skill is to be found in the pretty villa which he erected for Sir Charles Asgill, on the margin of the Thames at Richmond. Without a column, without a pilaster, without anything appertaining to the five orders,—with nothing that can be strictly called architectural but the cantalived cornice, such as used by Inigo Jones in Covent-garden church—he has composed an edifice so picturesque in form, and playful in light and shade, that may defy competition from such simple materials. The centre stands forward and rises higher than the two attached wings; a three-windowed bow projects from the centre and rises the entire height; the ground story is rusticated and surmounted by a stringcourse and dadoed moulding, upon which rests the windows of the one-pair story; square attic windows mark the upper story of the centre, and the projecting cornice crowns it in front and sides; the

wings form semi-pediments, resting against the flanks and centre, looking like contreforts or buttresses to the main building. The eastern and western fronts—for there are no flank walls—have similar bows to the ground story, only the upper parts of which form balconies to the superior story.

Looking at this villa from the opposite side of the river, or from the river itself, the pyramidal form of the composition, aided by the beautiful trees and scenery which surround it, give it an indescribable grace of picturesque beauty, that must find value in a painter's eye. Had the architect separated the villa from the road by a parapet-wall or balustrade, half its picturesque beauty would have been lost. Instead of which, he has enclosed its lawn by a mere protective row of iron rails, which makes the river appear to be part and parcel of the design. Nor is its appearance from the east or the west, on the Richmond side of the river, less perfect or beautiful, showing that the architect must have designed it *en masse* and in perspective, like a painter; and not on the drawing-board, with a T-square and compasses, like a carpenter.

Surely Sir Robert Taylor must take his place among the greatest of English architects.

(To be continued.)

CANDIDUS'S NOTE-BOOK.
FASCICULUS LXXV.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. Now that *Punch* has pounced upon the palace, people will, perhaps, begin to open their eyes to that architectural enormity, and also to open their mouths pretty freely on the subject. At least so it is to be hoped, since it is only by clamouring, and clamouring very loudly indeed, that we can hope to put a stop to similar delinquencies against taste, and similar mismanagement for the future. One would have thought that just after the outcry about the "Arch and Statue," all those who were in any way concerned with the projected alteration of the Palace, would have exercised a little discretion, and paid some little show of deference to public feeling. Instead of which, the only caution taken was the most unhappy one, as it now proves, of precipitating the business in the most hurried manner,—not altogether without reason, though a very bad one, for never would the public voice have sanctioned such a design for the occasion as that which received the *imprimatur* of parliament. It may be questioned if any one individual—even any one of those who affixed their signatures to the designs presented "to both Houses"—bestowed any sort of examination upon them. If they really did do so, what is to be thought of their judgment? Or was it taken for granted that the designs had been duly examined and fully considered by some responsible authority? Where responsibility for the choice actually lies, it is easier to guess than it may be exactly decorous to say. Assuredly not with the architect himself, for his incapacity would have been harmless, had it not been for the incapacity of judgment or careless indiscretion which suffered him to be employed. The lady who can dismiss a minister from her council board, can surely dismiss an architect from her service. At any rate there was no necessity for her employing that particular architect on an occasion that did not fall within the course of his usual official duties.

II. Buckingham Palace looks if not exactly more insignificant in style, of far more plebeian quality than before, and is, besides, greatly worse than ever as an architectural composition, the addition to it forming a lumpish mass, which, owing to its jutting out abruptly from the two low wings which are left standing, seems to encroach upon and disfigure the Park. Previous to the alteration, the principal mass of building had at any rate an architectural framing to it, whereas the present "façade" has none. Not only do the above-mentioned portions not belong to it, but they cause it to appear more lumpish—more of an excrescence than it otherwise might do.—Were royal palaces erected every day, we could tolerate a few blunders now and then, in the hope of obtaining something very much better the next time; but such not being the case, the utmost ought to be made of the opportunity which actually occurs; every possible precaution ought to be taken to insure not a merely good, but a very superior design; and Mr. Blore's most assuredly does not answer to such character, since apart from all its other numerous deficiencies, it does not exhibit a single touch of imagination, or fancy, or artistic feeling. In sad and sober truth, the design is nothing more or less than the production of a Pecksniffian drawing-board. Altogether of the most ordinary quality, it manifests impotence of conception, and total want of imagination and fancy, whether as regards the whole or the separate parts. Yet, as the building stood before it was begun to be *doctored*, there was much in it to prompt contrivance, since it held out many tolerably obvious hints for improvement, all which have now been overlooked. As far as the public are concerned with it, the Palace is worse than ever—a more decidedly offensive architectural object than before, and the very reverse of any improvement to the Park. And what renders the matter all the more provokingly vexatious is that not the slightest pains were taken to endeavour to satisfy the public. Vast indeed must have been the opinion of, and the confidence in, Mr. Blore's talent, to abide by such a "Hobson's choice," without letting there be even so much as a chance for anything more worthy the occasion being produced. One thing at least ought to have been seriously considered, namely, that little less than assured certainty of success warranted the risking such a decisive step as the one taken,—one that only the most complete success could justify. Had we been taken by an agreeable surprise,—had—after all the misgivings and apprehensions excited by very suspicious mysteriousness—the new façade burst upon us arrayed in beauty and magnificence, there could then have been no question as to the propriety of a mode of procedure that might up to that time have appeared both arbitrary and injudicious, both of which, we conceive, it will be considered now. As the patron of the Institute of British Architects, her Majesty might surely have afforded those whom she so royally and graciously countenances, the opportunity of exerting their talents on an occasion that ought to have inspirited and inspired them. There are persons in the world who are so exceedingly clever and Machiavellian that they over-reach and cheat themselves; who has done so in this particular instance, we will not say; nor should we so much care, were it not that John Bull pays for all in more ways than one,—not in pocket merely, but in reputation also. Foreigners will now have fresh cause to sneer at his taste, or the taste foisted upon him. They—happy dogs! may grin, while we can only groan. As to Mr. Blore, he may console himself one way, since he may now truly remark with Byron, that he got up one morning and found himself famous—his name is everybody's mouth, from north to south,—his fame (not quite the best) spreading wide from east to west, or what's the same, spreading at least from west to east. Still no one cries encore! to the achievements of the far-famed Blore.

III. Should the Architectural Association act up to its professions and intentions, much benefit may be anticipated from it. It promises to call the attention of the student to what is so greatly neglected, or rather altogether overlooked, in his ordinary professional education—namely, artistic apprehension of architecture, as distinct from mere building, in its quality of fine art. The Association consists chiefly of juniors,—and it is to the juniors and the rising generation in the profession, that we must look forward for more liberal, enlarged, and worthy notions than those which have hitherto prevailed in these latter times, when the art has degenerated into what is little more than empirical routine on the one hand, and twaddling pedantry on the other. Since they seem so disposed, let the seniors in the profession go comfortably to sleep, provided the juniors are awake, and awake a better state of things. Let them boldly break the trammels in which their art has so long been confined,—fetters of unbending iron to the timid and the weak, but feeble as cobwebs to the firm and the resolute,—the mere flimsy spider-spinnings of pedantic brains.

IV. The nation is, it seems—at least, according to some people's fancies—very much richer than it was a short time ago, in consequence of the prodigiously valuable acquisition of Shakspeare's House—the only house, by the by, that can be called his, he being now ejected and kicked out from his legitimate dramatic domicile—the theatre. Shakspeare's House! what an immense quantity of drivelling sentiment was poured out just before the time of the sale of that rubbishly old tenement! Yet we laugh and sneer at, and ridicule the reverence of Roman Catholics for relics as besotted superstition,—our own Protestant superstitions being at the same time not a whit less absurd and crazy. However others may be affected at the sight of them, I know not; but such vulgar objects as Wilkie's palette, in the pedestal of his statue at the National Gallery, and Nelson's coat, in the Painted-hall at Greenwich, only excite my thorough contempt, as the veriest buffoonery aping reverential admiration and affection. This species of superstition becomes little less than downright imbecillity, when the objects of it are absolutely insignificant and uninter-

esting in themselves, and have no other value than their very problematical genuineness,—as is the case with the two reliques afore-named, it being just as likely as not that that identical palette was never in Wilkie's hands, or that identical coat upon Nelson's back. Again, as to Shakspeare's House, it is quite certain that no such inviolable precautions were taken to preserve it for ever and a day intact, as were taken by Soane to maintain his domicile in all its pristine excellence.

V. That our late Greekomania should now be greatly chilled, is no wonder, for our Grecianism had fairly worn itself out. It was in a manner starved to death, owing to its not having received the slightest nourishment from any new ideas infused into it. Nothing more was made of it than just what it was at first. Instead of attempting to treat it with free artistic gusto, to mould it according to actual circumstances, and also to keep up consistently, through every part of a building, the style so dictated, we contented ourselves with little more than copying in the most humdrum manner the fronts of ancient temples for classical porticoes, with no other variations than Doric, Ionic, and Corinthian—tetrastyle, hexastyle, and octastyle. Nearly one and all were the merest mechanical copies; and precisely the same examples were repeated over and over again, in the most wearisome manner. It seemed as if we were ambitious of rendering the scanty resources of design afforded by Grecian architecture, even when availed of to its fullest extent, still more scanty, by exploding all but one or two of the most familiar examples. Nor was penury of ideas and inventive taste all, there being also, for the most part, great penuriousness in the general design of the buildings themselves and their execution. In many instances, even the ordinary decencies of design were wholly disregarded,—wherefore, in spite of their Greek columns, the would-be classical structures proclaimed themselves to be arrant Cockneyism, and that of the very worst and most vulgar kind of all, because accompanied by despicably paltry affectations. Nevertheless, such things were admired,—were complimented in newspapers, and extolled in guide-books, which exultingly called the attention of visitors to what they described as "a great ornament to our town."—In a word, we had, by the unhappy use we made of it, converted Greek architecture into the most humdrum sort of design. Nay, it seems to have paralysed our powers of design and composition altogether, so that the only alternative left us was to escape from it by plunging *headlong* into the Gothic and Italian styles.

VI. No one can say that I do not encore Buckingham Palace, after one fashion at least; for my pen is itching to twitch at it again—*le voici!*

> One vast difference, I ween,
> Little Florence between
> And our huge overgrown city,
> Is—to speak more in grief than in malice—
> The first has the palace whose name is the Pitti,
> We, a petty and pitiful palace.

We groan, we grin by turns at it, nor groan the less when we consider what our neighbours have lately made of their—not royal, but municipal palace, the Hotel de Ville at Paris, whose Grand Gallery, or banquetting-room, quite eclipses our House of Peers, and all else that is contemplated for the interior of the Palace of Westminster.

VII. A Real Architectura. Dictionary is a desideratum not likely to be speedily supplied. By *real* is to be understood one which treats of *things;* one therefore, which, instead of confining itself—if not exactly to mere definitions, to a very brief account of the respective matters, should enter fully into the subjects connected with the terms explained, and supposing a work to be executed satisfactorily, some of the articles would require to be of considerable length. And to be well executed, it ought to be exclusively architectural, otherwise it would exceed all convenient bounds, there being a very great deal, hitherto scarcely touched at all in any shape, that would come under cognizance in such a work. In fact, as compared with its mass and the number of publications belonging to it, architectural literature is remarkably meagre as to substance, and in regard to information to be derived from it. The greater portion consists of what is very little more than repetition, and that mere compilation, with scarcely so much as a fresh thought or remark infused into it. What work can we find which goes into the subject—and a very important and highly interesting one it is—of architectural Composition? In fact, the term itself is altogether ignored in dictionaries calling themselves architectural ones, although it would afford matter not merely for pages, but for entire volumes. Nevertheless, not so much as a single one on it has been produced. "Effect"—which, by the by, belongs to and is included in Composition—is another term that would form an article of some length in a dictionary of the kind in question. A great number of other terms, expressive of different qualities and characters, but now rendered almost unmeaning by the indiscriminate and ignorant manner in which they are applied—often at mere random—would require to be introduced, and to be most carefully analyzed and explained,—explained moreover by copious instances and examples; because, without such express elucidation, criticism becomes mere fumbling in the dark, whereas in architecture it cannot possibly be rendered too definite and exact. Take "Simplicity,"—ask any man supposed to be tolerably *au fait* in architecture what he understands by it, and instead of an intelligible reply you will get a vast deal of hemming and ha' ing, and perhaps at last the very profound information that Simplicity is—Simplicity; and so throughout the entire list. Not least strange of all is it, that in dictionaries, glossaries, or whatever else they are styled, of the class alluded to, no notice is taken of such exceedingly obvious terms as Cinque-cento, Renaissance, Rococo, Louis Quatorze mode, or Italian style generally, with the Florentine and Venetian in particular. What exemplary attention Nicholson bestowed on his Architectural Dictionary may be conceived from the almost incredible fact of his omitting, *inter alia*, the term "Spire;" one which, if properly drawn up, would have brought together some account and description of all the principal structures of that class. Both "Campanile" and "Belvedere Tower" might also be made to furnish very interesting articles. There are besides a prodigious number of similar matters and terms, which, if not exactly passed over altogether, have hitherto been dismissed with exceedingly *jejune* notices of them. As far as it goes, Parker's Glossary is the best work we have of the kind, is economical in form and admirable in some of its wood-cut illustrations; but it is so exclusively mediæval, that it would have been better had it confined itself entirely to the architecture of that period, without pretending to embrace "Grecian, Roman, and Italian," which are treated so very begrudgingly as to be made to appear comparatively quite secondary, if not actually unworthy; whereas, in a work of the kind, whatever is introduced at all, ought to obtain due and impartial attention. Had the last-mentioned styles been omitted by Parker, as not coming within his plan, there would then have been an opening for a similar illustrated "Glossary," exclusively devoted in turn to them.

VENICE; AND HER ARTS.

By Frederick Lush.

> O Italy, the fallen! once thy soul
> Of high and noble impulses was full,
> And in its lofty might could spurn controul,
> And find a place for all things beautiful.
> Noble and lovely in thy pride thou wert;—
> O wherefore could'st thou bear to stoop so low?
> Better have died thy freedom to assert,
> Than tamely crouch 'neath the degrading blow!
> But the vast Knowledge which o'er earth's wide plains,
> Is sweeping like a mighty rushing wind,
> Has reach'd e'en thee, and in thy languid veins
> The pulse is quick'ning—to thyself be kind,
> Call back the old high feelings to thine heart,
> And let it glow once more with Freedom, Truth, and Art!
>
> Anne A. Fremont.

A city, like Venice, so extraordinary in its position; rising out of the sea as if by enchantment; presenting so many picturesque appearances; and unfolding in the pages of its history so much of the fairy-tale and romance, cannot but be beheld with emotions the most lively and enthusiastic. In many respects, she is not unlike what we conceive from description ancient Tyre to have been, and fully deserves the eulogium that was passed upon that celebrated capital:—"Thou art a merchant of the people for many isles..... thy borders are in the midst of the seas, thy builders have perfected thy beauty.... princes were thy merchants, and occupied in thy fairs; and chief of all spices, with all precious stones and gold and chests of rich apparel, were amongst thy merchandise.... thou wast replenished and made very glorious in the midst of the seas."*

The sensations which Venice produces are the more powerfully preserved, from the fact that the spot, which has witnessed some of the most interesting events that have occurred in Europe, and which displays some of the most wonderful and curious creations of the ingenuity of man, receives a considerable degree of its splendour and attraction from the beautiful climate and glowing sun of the Adriatic, in which it was cradled. Viewed when her spires, her cupolas, and palaces are suffused with the

* Ezekiel, chap. 27.

ruby rays of the setting sun, or repose in the silvery moonlight; at Ave Maria, when the bells proclaim the hour of prayer, or music sends forth its streams of harmony from the crowded Piazza; or at midnight, when the impassioned notes of some gondolier's song or lover's serenade alone break the prevailing tranquility;—the sounds and the emotions which are then heard and experienced—the purity and intensity of which are increased by a profound silence and a still atmosphere—impress this city of poetry and song for ever upon our recollection.

Venice is proverbial, even in Italy, for the beauty of her sunsets, and it will not be a matter of surprise to those who consider the influence of external objects over the feelings and imagination, why the Venetian painters—Giorgione, Titian, Tintoretto, &c.—acquired such perfection of colouring, and warmed the subjects depicted on their canvas with the resplendent hues of their native skies. A clear perception of the beautiful in nature; a lively fancy easily captivated by the charms of that colour which surrounded them, joined to a power of imitation which enabled them to express it in their productions, making their pictures look as though the sun shed its dyes of gold, vermilion, and purple upon them,—stamped the golden period of the Venetian school of painting with a magical brilliancy and splendour of colouring, which, as it sprung out of natural feelings, and was grounded on the most poetical associations, so it was the beautiful and striking feature that characterized this school; a palm of merit which none other has been able to dispute with them. Although belonging to the ornamental style—placed by Reynolds in the second rank next to the grand style, and considered inferior to the Roman—yet "the national genius," as Lanzi says, "always lively and joyous, sought to develope itself in more brilliant colours than those of any other school;" and we trace this feeling not only in their architecture and in the architectural accessories of their pictures, but find it entering into every thing they undertake, and investing with greater show and pomp their favourite festivals, their regattas, processions, and all their public exhibitions. Besides, the climate and scenery of Venice—without even referring to those popular games and festivals, which were so many theatres for poetry and opportunities for displaying the artistic talent of the people—demanded from the arts a degree of splendour which in other places would have been deemed superfluous and ostentatious. Those arts, moreover, in contributing to the scenery, were in return heightened by the climate; all received additional lustre from the pure light under which they were exhibited. It is this which so strongly augments the effect of every feature of the landscape; and, at the same time, leaves such vivid impressions on the spectator: which makes the foliage of the trees glow like emerald; and the islands and gardens seem as though they floated in a sea of sapphire.

It is this climate—the luminous, phosphoric haze that warms and gilds and shines upon Venice—as well as the oriental aspect of the city—which the traveller gazing upon knows to be the chosen abode of the genius of the arts and poetry; and as such, although the hackneyed sounds of the world are removed from it—though it never hears the tramp of horse or the "car rattling o'er the stony street"—yet he will not experience the melancholy and depression that is engendered beneath the gloom of the lengthened arcades of Bologna, or the solitary, deserted streets of Ferrara.

The poet or artist, yielding to the charms which are scattered over Venice in such profusion; looking upon the pearls and precious stones which shine in the crown of the Queen of the Adriatic; the dazzling robe in which she is arrayed, as she sits "enthroned on her hundred isles;" as he listens to the tones of sweetest melody, and catches the perfume of delicious fragrance as he glides over canals meandering

> "——————— by many a dome
> Mosque-like, and many a stately portico,
> The statues rang'd along an azure sky;
> By many a pile in more than Eastern pride,
> Of old the residence of merchant-kings;
> The fronts of some, tho' Time had shatter'd them,
> Still glowing with the richest hues of art,
> As tho' the wealth within them had run o'er;"*

will feel that this city, selected as it was for enacting, as it must have enhanced, those pageantries and ceremonials for which it was renowned in the days of its republic, must suggest to the Venetians of the present day, when thinking of its faded glories, the lamentation, so applicable to many other cities of the past—*Venezia! Venezia! Venezia! Venezia, non è più com' era prima!*

* Rogers's poem of "Italy."

It cannot be unprofitable or uninteresting to allude to some of the arts which adorn this beautiful city,—arts of which it has been miserably despoiled by wars; yet of which, sufficient remains to convince us that they were cultivated and brought by the Venetians to a very high degree of splendour. Sansovino, their historian, acquaints us, that in the most flourishing period of Venice, there was not a city in the world which possessed so many works collected from antiquity, or could boast of such large galleries of pictures, statues, bassi-relievi, bronzes, engraved stones and metals, mosaics, tapestries, and all kinds of inlaid work; and that the opulent citizens and wealthy patricians, ambitious to amass everything that was a token of wealth, indication of commerce, or evidence of refinement, endeavoured to outvie each other in the number and beauty of these productions. But these were acquired, perhaps, more from foreign, than from the sources of their own country: and the slightest investigation into the history of this city, and the causes of its greatness and wealth, soon lays open to us the beneficial tendency of commerce upon the arts—and through this channel, a way to their increase and prosperity. The enterprising and "devoted bands of patriots," who, driven by Attila, set to work, like beavers, and built Venice on wooden piles in the ebbing and flowing tide, would not be wanting, nor their sons neither, in their command over the riches of the East, &c., by ploughing the ocean and navigating along the ancient seats of the fine arts upon the Asiatic and Grecian coasts, the shores of the tropical peninsulas, and the islands which stud the Archipelago, for the purpose of there founding colonies and emporiums of commerce—by means of intercourse with which, their first city would grow rich, beautiful, and prosperous. And such was the case. The treasures of art and the relics of antiquity, accumulated from foreign countries, were contributed towards the adorning of churches and public edifices; were the cause of that ornamental character, yet heterogeneous mixture, which we see in many of the buildings; and many of them enriched, and still exist in, the galleries of the old palaces of the Pisani, Contarini, Cornari, Grimani, and of other ancient patrician families;—each of which, whilst displaying an example of curious and beautiful architecture in itself, contains also a museum for the study and admiration of the antique.

The influence of commerce over the fine arts of Venice was great; and although the state could not boast of much extent of territory, nor a large amount of population—yet, by extending their commercial relations with other countries, and imitating as it were the example of ancient Tyre or Carthage, their fame and their sovereignty was conspicuous, and excited the envy of many a cotemporary republic. The skilled pilots who trafficked in the marts of the Levant, and brought home cunning artificers from Arabia, and Grecian artists from the Lower Empire, were the true pioneers of civilization. To the labours of these foreigners, Venice and the Venetians are greatly indebted,—not only for the Byzantine architecture of St. Mark (of which they are so justly proud), and of many other of the earlier edifices in this style, but likewise to the curious art of mosaic and various tesselated work with which it abounds. These picture-like representations, so particularly appropriate to the decorations of either Gothic or Byzantine churches, possess distinguished advantages over frescoes, in point of permanency of colour. Many very ancient specimens still remain—even such as have been exposed to the action of the open air, although their durability is seldom put to this trial; yet, in the case of fresco-paintings which have been exposed to the sirocco and the sea-breezes, the vividness of their original tints has entirely faded away,—the subject, under such influences, being sometimes scarcely discernible.

The early mosaics extant in Venice are considered by some writers as being the first essays of the art of painting in that city; but, as Lanzi remarks, in his account of the Venetian painters—"the artificers, however rude, must have been acquainted, in some degree, with the art of painting; none being enabled to work in mosaic who had not previously designed and coloured, upon pasteboard or cartoon, the composition they intended to execute."*

The same author mentions some mosaics of Grado, wrought in the sixth century (a century or more after the foundation of Venice, which was about A.D. 451), those of Torcello, and a few other specimens that appeared in Venice, in the islands, and in Terra Firma, produced at periods subsequent to the increase of the grandeur of the Venetian state, which attained its climax soon after the taking of Constantinople, in 1204. About the

* Roscoe's Translation.

year 1070, the Doge Selvo invited mosaic-workers from the capital of Byzantium, to adorn the basilica of St. Mark, for in that the Venetians were desirous to emulate or surpass the church of S. Sophia. Andrea Tafi, a Florentine, cotemporary with Cimabue, studied under those Grecian artists; from whom he obtained the materials of that fame which he afterwards acquired in the mosaics executed by him in the baptistery of his native city: and hence it is the opinion of Flaxman,* that the elements, as well as the perfection of the arts, have always been received, either immediately or intermediately, from the Greeks, by Western Europe; although, he adds, this has been denied by Vasari—and, as far as concerns the Greek Christian paintings, does not seem to have been even suspected by Winckelmann.

There are two sorts of mosaics, as they are also referable to two different epochs. The most ancient belong to the foundation of the basilica of St. Mark (at the close of the tenth century), and to the first introduction of this art into Italy from the Byzantines. The famous *Pala d'Oro* was executed by the mosaicisti of the first period, and which, entirely composed of plates and figures of gold and silver upon enamel, offers a beautiful example of the rich and elaborate workmanship of the Greeks of the Lower Empire. The mosaics which for contra-distinction we might call modern, were commenced in the latter years of the fifteenth century, and are attributed chiefly to the two brothers Zuccati, Francesco and Valerio, sons of the painter Sebastiano Zuccati, of Trevisa, who instructed Titian in the elementary lessons of drawing. The Zuccati executed these mosaics by means of cartoons, drawn by the best artists of the time, and from copies furnished by Titian or Tintoretto. The subjects are generally conceived from the descriptions of the Old and New Testaments.†

What, even at the present day, is so rich and splendid in St. Mark's, are the vaults of burnished gold; and it is these, with the sheen of various metals, bronze, silver, and sparkling stones—vieing with the most brilliantly-painted ornaments, Moorish and Byzantine—which give such a strong oriental character to this singular and interesting pile. The inlaying of figures in coloured pieces of stone on a surface of gold, perfectly corresponds with, and is analogous in effect to, the pictures of the Greeks, which were invariably painted on a golden background. Covering wood and other substances with this valuable material was common among the Egyptians, and was extensively practised by all the nations of antiquity. Vestiges of gold leaves and gilded ornaments are still traceable in the ruins of many ancient edifices in Greece, Persia, Arabia, Italy, and other countries; and are often found in a high state of preservation. Although the golden vaults of San Marco may be tarnished by time, still it is easy to imagine how very beautiful must have been their appearance in by-gone days. The early Venetian painters used gold in their pictures, as if they thought it indispensable to the due representation of the gorgeous *fêtes* which were celebrated in their city: Gentile Bellini may be mentioned as an instance, in his painting of the religious ceremony of *Corpus Domini*, in the Piazza di San Marco. For a long time afterwards, the Italians employed gold for the glories of their saints, and the fringes and ornaments of their costume.

Painting on glass and in enamel, another art in which the Venetians excelled, was also in ancient times carried to a very great extent. The glass-houses at Alexandria were celebrated for the skill and ingenuity of the workmen. The Alexandrines were fond of exhibiting glass cups, which sparkled with colours of every kind, at their grand festivals. This art was thence imported into Venice, and down to the present moment has had a great deal of attention devoted to it; for none can be insensible to the magical brilliancy reflected from the ancient windows of foreign or British cathedrals. When it was but little known, a transparent marble or alabaster of beautiful colours, called *lapis specularis*, was sometimes as a substitute introduced for effect in the windows of churches; as we see, for one, in San Miniato at Florence.

The Saracens introduced into Venice tapestries from Cairo, as that city was famous for the manufacture of them; and the processions which conveyed thence to Mecca the most beautiful hangings which Cairo could produce, was quite a religious affair, and was got up entirely regardless of expense. This ceremony is described by bishop Pococke in his "Travels in the East."

Tapestries were and are at this day the great ornament of churches in Italy and all Roman catholic countries, the finest being copies of celebrated pictures, sometimes issued from the Gobelin manufactory, and are exhibited to the public on the occasion of any great festival; and none so fond of doing so as the Venetians.

In Venice, and in all other states—especially in the early periods of their history and civilization—those artists and artificers were at a high premium who excelled in mosaic, in gilding, in the working of different metals, in weaving cloths and silks, in colouring glass, or in painting on walls; and these arts, valued on account of their curious and elaborate execution, which far surpassed the material, as well as for the effect which they imparted to civil and religious edifices, obtained the universal and lasting favour of all civilised and enlightened countries: the knowledge of the principles and processes employed in them spread rapidly throughout the whole of Europe; the moderns contributed to their perfection; and they were most assiduously cultivated by the monks during the middle ages. The greatest artists have not disdained to make researches into these subjects, being sensible of their utility in point of decoration, and as being auxiliaries to more noble arts: Michael Angelo turned his attention this way; and Ciampini, in his "*Vetera Monumenta*," prefaces his history of the ancient basilicas with an enquiry, illustrated by plates, into the antiquity of mosaics, attributing their invention to the Greeks of the Lower Empire.

We have above alluded to some of the arts which originally belonged to, and were introduced into Venice from, the Asiatic and Arab countries, because of the oriental physiognomy which she first assumed from this connexion and influence; and pursuing this track, we shall now mention the vestiges of Saracenic architecture which she presents, together with its characteristics,—before speaking of Venice after the Italian invasion of the new but beautiful style of the *cinque-cento*.

St. Mark's deserves our first consideration, being the most oriental of all the edifices in Venice, and the most remarkable in Christendom. Combining, as it were, the mosque or Mahommedan house of prayer with the Christian temple—loaded alike with the productions of art and the trophies of conquest—there is probably no other edifice in the world which appeals to the spectator by so many powerful associations, or is suggestive of such extraordinary reflections, as St. Mark's. It is the primary and principal object which excites the curiosity and fills the imagination of the traveller in Venice: let him have visited what wonders he may, its strange but beautiful façade will strike him as something that has no parallel. Although there are mingled together details the most heterogeneous and strangely sorted, still the effect of its colours and proportions enchant, as if the beautiful Byzantine and Arabic styles compensated for and concealed the boldness of a work which was produced in contradiction to the severe rules of art. Then, singular enough, although the Venetians can boast of no hippodrome, neither indulge in horsemanship or steeple-chases, yet they can point with national pride to the four bronze steeds over the central porch of their cathedral,*—for they are monuments of their former greatness, though not, unfortunately, works of a first-rate character.

The exterior of St. Mark's, with its domes and minarets, its height from the ground, and its profusion of ornament, resembles a mosque of the Saracens; whilst within, it is more like a Mussulman than a Christian temple. There its narrow naves, instead of terminating in light and lofty arches, are confined and roofed-in by low, heavy vaults. Yet these vaults, covered over with gold, are supported by upwards of five hundred columns of precious marble, veined, black, and white; alabaster, bronze, serpentine, and verdo-antico; and the tesselated pavement is formed of most exquisite jasper and porphyry. The arabesques, chisellings, bas-reliefs, and statuary—the works severally, of antiquity, of the Byzantine artists, and of artists of a subsequent age—here appear as if in competition of their respective merits; whilst those portions of the walls and the vaultings which do not glitter with burnished gold or precious stones, contain the mosaics (already mentioned) of two separate epochs—those attributable to the Greeks, and those produced by the Italians.

With all that has been said in praise of St. Mark's, much has been said in censure, and we can imagine such would be the case. There are some objects so entirely out of the sphere of the usual routine and exercise of the understanding and taste, that the mind, occupied and absorbed with others more congenial to its inclinations or habits, feels for the former no

* "Lectures on Sculpture."

† Of the capability of mosaic to produce all the tones and gradations of light and shade equally with the brush, we have convincing proofs in the copy of Raphael's "Transfiguration," in St. Peter's, Rome; which is a close resemblance of, and assimilation in effect to, the original

* "It is astonishing," wrote Haydon, "that the great principles of nature should have been so nearly lost in the time between Phidias and Lysippus. Compare these two heads [the Elgin head and that by Lysippus]. The Elgin head is all truth: the other all manner. In the Lysippus' head, the great characteristics of nature are violated for the sake of an artificial effect; in the former head, the great and inherent characteristics of nature are elevated without violation. Inasmuch as the Elgin horse's head differs from and is superior to the head by Lysippus, so do the rest of the Elgin marbles differ from and are superior to all other statues of this and every subsequent age."

interest or concern; rejects them, perhaps, with indifference and contempt; pronounces them as useless or absurd; or, at least, does not receive them as fit and welcome objects for its study and contemplation. Even the educated eye and cultivated taste of the real connoisseur before St. Mark's, may fail to see and discern its beauties, and may err in the judgment and opinion he forms of it, by a mind unfavourably disposed towards it; incapable, from its condition, of becoming the recipient of, or yielding assent to, its peculiar merits; and alike incapacitated to understand and enjoy them. Instead of testing a work and the qualities associated with it by the particular frame and constitution of our own minds, and some standard of our own therein set up, it is essential in all criticism of fine art, to feel as the author or artist felt, to know with what idea and intention he was animated and possessed, and to judge according to the circumstances of the age in which it emanated,—if we would renounce partiality and avoid misinterpretation. Hence, Schlegel said: "No man has so deeply penetrated into the innermost spirit of Grecian art as Winckelmann; he transformed himself completely into an ancient, and seemingly lived in his own country, unmoved by its spirit and influences."*

Admitting all the faults of St. Mark's; admitting that semi-barbaric character impressed upon it by the extravagant use of costly materials,—we must, at the same time, confess that to our eyes this very wildness and exuberance caused much of the pleasing emotion we experienced. We thought that its architectonic forms and ornaments (faulty as they are often considered to be by many Europeans) were extremely effective; and, although the boldest that the hand of man ever ventured to employ, that they were as appropriate and significant to the intentions and purposes of St. Mark's as could possibly be conceived. Long familiarity with its peculiarities only deepened this conviction. Long familiarity did not make it look ordinary or tame. But long, frequent, and intense contemplation only developed its beauties, and manifested its deep symbolical significance.

It is difficult, if not impossible, to do anything like justice to St. Mark's with the pen; nor is it intended to offer a complete description;—pictures and dioramas can alone convey an adequate representation of its splendour: to these we refer the reader, and we think that he will therein see a corroboration of our remarks—namely, that its architecture is in admirable keeping with the buildings which surround it; and that its effect, in its place and in relation to its scenery, is everything that could be desired, and the principal ornament and attraction of the great Square in which it is erected.

(To be continued.)

* Lectures on Dramatic Art and Literature.

MUNICH IN 1847.

Somewhat extraordinary it undeniably is that no English artist or publisher should have thought it worth while to give us any illustrations of the capital of Bavaria, for besides that no engravings of the kind—that is, views of the modern, especially the recent structures at Munich, have been brought out in Germany, they would have a chance of being very much better executed here, there being in Germany itself no medium, apparently, between very expensive and large-sized works—consequently the very reverse of popular in price or shape, and the most paltry productions conceiveable—the very doggrel of the pencil. Munich, as it now presents itself, has been styled the Paradise of Architects,—perhaps somewhat incorrectly, at least as far as English architects are concerned, since it must excite in them sundry very unpalatable comparisons with not build ings alone, but the general system of architectural management here at home—that is, if what seems to be conducted upon no systematic scheme of management at all, can so be termed. What has been achieved of late years at Munich with comparatively limited means is almost incomprehensible to Englishmen; but the great secret is, that if the means have been limited, the intelligence and the will that directed them have been great and energetic. We, on the contrary—but comparisons are odorous, as Mrs. Malaprop says, therefore, perhaps, we had better drop them altogether, and forego any allusions to royal taste and royal sympathy with Art, here at home.

Among the more recent and as yet incomplete works at Munich is the "Wittelsbacher Palast," in a style partaking of our own later mediæval architecture. The edifice is described as a quadrangular pile with four octangular towers rising at its corners, and with a projecting pavilion in the centre of the principal façade. The whole is partly of a warm red and partly of a decidedly yellow tint, wherefore the building shows very forcibly against a clear blue sky. Another building designed by the same architect (the late Professor Gärtner) is the Neue Friedhof or Cemetery, forming a quadrangular inclosure or Campo Santo, with forty-three arches on each of its longer, and forty on each of its shorter sides, consequently nearly a square in its plan. All the arches are thirteen feet in width, semicircular, or, to speak accurately, something more, the curve being just returned below the chord, whereby a peculiar expression and lightness are imparted to the arches, which rest upon octangular pillars. In the spandrel surface between the arches is a medallion, and the elevations are finished by a console cornice. Internally, these arcades or cloisters have rich open-work timber ceilings, and their walls afford adequate spaces for both pictorial and sculpturesque decoration. How vastly superior, we may remark, such a well disposed *ensemble* to the paltry higgledy-piggledy appearance presented by our own modern cemeteries—that of Kensal Green especially, with its atrociously vulgar, not to call them profane monuments, recording such worthies as Pill-Morrison, St. John Long, and Ducrow the equestrian—company in which no one would care to be buried, lest—the readers will supply the hiatus.

Not the least important building of all now in progress at Munich is the Neue Pinakothek, which is intended for the reception of productions in porcelain and glass-painting in the ground-floor rooms, and for pictures by modern artists in the upper ones. This second Pinakothek, the architect of which is Professor Voit, will not be so extensive an edifice as the first one, its length not exceeding 368 feet, while that of the other is 520. In regard to style and general form, also the arrangement of its plan, it will be somewhat similar, but in the physiognomy of its principal façade will be almost unique; it being intended to decorate the whole of that its south-side, above the ground-floor, with mural painting. That surface, about 360 feet in length, by 26 feet in height, will be divided longitudinally into compartments, so as to form a series of historical compositions, the cartoons for which have been already prepared by Kaulbach. The entrance is in the east front, and beyond the vestibule will be a double staircase—that is, two ascents, one on each side, conducting to the upper floor, first into five spacious exhibition rooms, with as many smaller ones on the south side, all of which will be lighted entirely from above. On the north side of the middle suite of rooms, will be fourteen cabinets, each having a side light, and these will, of course, be accordingly appropriated to pictures of cabinet size. On this floor the western end of the plan will be occupied by a single room upwards of 90 by 50 feet. It is intended exclusively for the reception of a series of landscapes by Rottmann,—a set of views in Greece, which he was commissioned to paint for the king. And that Rottmann's-Saal, as it is to be named, will be so peculiar in character—so unlike all other picture-galleries or exhibition rooms, as to deserve here such an account as we can at present give of it. It will be divided by columns into twenty-four intercolumns or compartments around its sides, and of those compartments—which, we presume, will form distinct recesses, after the manner of those in the Glyptotheca of the Colosseum here in London,—twenty-three will be occupied by as many landscapes; and besides that such uniform architectural arrangement is altogether uncommon in a gallery of the kind, the effect will be extraordinarily enhanced by the entirely novel mode of lighting adopted for it,—one that will realise an idea which we ourselves have ere now entertained. No light will be admitted directly into the centre space or room itself, but only upon the walls within the compartments, so that while the space in which the spectator stands will be in *demi-jour*, the light will be thrown upon the paintings, each of which will be completely framed in, as a separate view, by the two columns between which it will be seen, whereby a considerable degree of illusion can hardly fail to be produced. Here then is an idea that might be turned to excellent account for a Panorama, since it would undoubtedly be an improvement were the "platform" at such place of exhibition enclosed by columns or pillars of some kind supporting its roof.

The Rottmann's Saal, and the five-rooms in the south-side of the building, as also the cabinets on the north-side, will be 26 feet high, but the five rooms in the centre of the plan will be about 50 feet high to the summit of their sky-lights, wherefore that portion of the structure will form a lofty mass towering above the rest of it. Besides what is going on in public works, a fresh field for their talent is now opening itself to the Munich architects, several of whom, including Metzger, Bürklein, Braunmühl, Moninger, and Kreuter, have erected various private mansions that deserve to be accounted among the embellishments of the Bavarian capital.

Would that we could look to Sir Edward Lytton Bulwer and some of the other English visitors who are now there, for their bringing home with them a little of the cordial love of architecture which there prevails.

THE BRITISH MUSEUM.

No. IV.

The collection of Greek and Roman domestic antiquities in what is called the Bronze Room, is at present in confusion and unlabelled, so that the examination is not very easy.

Such a collection is particularly useful to the student, as it enables him to get better ideas of the domestic life of the Greeks and Romans than he can from books and artistic works, and to correct his ideas as to their state of social advancement. The progress of the fine arts and of the mechanic arts is not necessarily correspondent; and we may find a people producing the most beautiful sculpture and painting who want common comforts, or another whose painting is barbarous, but whose domestic arts are well cultivated, as for instance in the case of the Chinese. While the Athenians made a great stride in sculpture between the time of the Egina marbles and of Phidias, it may be taken for granted that the progress of the useful arts was not so great. The invention of a new machine would have been needful to effect any great change. While we look to the cultivation of the fine arts, as having an equivalent effect on the manners of the people and in the advancement of artistic manufactures, it is evidently unequal to the production of mechanic skill; and we must be careful not to rely too much upon artistic instruction, nor to push it too far. The existence in a country of a general and refined taste is not inconsistent with the promotion of mechanical pursuits, and is favourable to them, but we must not try to give an artistic bias in education. At present our people get a good mechanical training, which makes them the best workmen in the world, and in trying to do more we must not lose this.

One reason why the flourishing state of the fine arts is no index of the state of the mechanical arts is, that the former are chiefly handmaids to wealth, and are employed either by a rich state, or by a few rich men, and are little enjoyed by the people individually. While the Athenians were raising the Parthenon and pouring out upon it all the riches of art, they themselves were living in wretched huts, which had no share in the largess. While the head men of Rome were filling their palaces with the greatest works of old and new art, the people were as ill-lodged as when Romulus and Remus began the town. The mechanical arts cannot, however, be pursued without all getting a share in their works. Sawed timber and wrought iron were luxuries among the ancients; when towns were taken by the Greeks, the planks and beams, the hinges and the nails, were carried off as the worthiest part of the plunder, but as the stock got bigger all classes were able to get a share. The husbandman willingly gave food for a plough, an axe, a bolt, a kettle, or a pan; but he would unwillingly have given food for a carving or a painting, from which he could have got nothing back. The fine arts became the servants of the rich, the mechanical arts the servants of the poor.

The fine arts are but one page in the history of civilization; the Egyptians could raise pyramids, the Russians have built a city of palaces, and have filled them with the choicest works of the west; but as in the former the people were wretched serfs, so they are in the latter. The state of the mechanical arts and their employment by all classes is a far better index of the condition of the people. Where the mechanical arts are degraded, as among the Romans, a slave-class must exist, and the free-class must be paupers, for idleness will do its work on all. In Ireland, if we have not slavery in the name of the law, yet slavery and pauperism are the lot of the people, and neglect of the mechanical arts may be reckoned among the concurring causes. Where so many hundreds of thousands of beggars are fed by the pauper-people, carpenters, smiths, quarrymen, masons, brick-makers, potters, bricklayers, and weavers might be as well fed. The English beggar-class are the hand-loom weavers, the lace makers, and straw plaiters: those kept at the common charge break stones, grind bones, pick oakum, make and mend the roads. In Ireland the beggar-class do nothing to keep up the common stock.

So far as words go, freedom and the fine arts may be spoken of in wider terms at Athens or at Corinth, than in London or in New York; but to judge we want something better than words. When we look at the handi-work of the Egyptians, Greeks, or Romans, although we may acknowledge in some things very fair workmanship, yet on the whole we cannot but feel that the people could not have had the same comfort, and therefore not the same health and length of life as ourselves. The bearing upon the man is the measure of civilization, words do not give it. There is the same air, the same soil, and the same law in Ireland, as in England; and yet the former is as well known for its beggary, as the latter for its wealth.

The reader of Thucydides, of Livy, and of Tacitus, may find in a hinge or a staple, a great commentary on the text of his author. He may see how painfully and how clumsily the commonest hardware was wrought, and he may learn with what toil, with what time, and with what cost an army or a fleet was fitted up, and how great was the wreck when it was lost. It was shameful to lose a shield, because it took more to buy a shield than a man; the warrior who lost his armour, lost, like a knight of the middle ages, what it would take many rich fields to buy again. A part of such spoil was hallowed in the temples, an offering as rich as gold and silver. With us gold and brass are not linked together, for they are as the top and the bottom wide apart; with Homer, gold, bronze, silver and tin rank as costly metals, for the workmanship of all being alike, the disproportion of the price of the material was less. To burn the town was to ruin the commonwealth which held it, for the mason's and carpenter's tools were costly, the work was slow, and an unsheltered people could not raise another town. Hence we find towns, once powerful and thickly peopled, which never rose from the wreck which had been made of them; and others were only able to do so because the walls were readily patched up, or because the foe had gone away by sea. It is for such reason that we have Cyclopean cities left to us as relics, which had been ruined in remote ages.

The best beginning for a sound knowledge of history and the progress of civilization is to be laid down by carefully reading the works of Homer and Hesiod; not the smoothed down Louis Quatorze Iliad of Pope, but the rough and rugged originals. From their works we get a knowledge of a people, afterwards highly polished, who beginning as wild robbers were then going through the first steps towards civilization. Not merely are the manners drawn, but the houses, the fields, the tools. We see the king, the warrior, the priest, the soothsayer, the husbandman, the brass-smith, the potter, the housewife, the Phœnician trader, and the sea-rover; but we see moreover the rough tillage of the field, the early seeds of art, the beginning of wealth. We have a lively painting of the dawn of civilization, such as Cook saw it in Tahiti or Hawaii. In the British Museum we have the tools of the Maori and the paper-cloth of the Tahitian; but we have likewise such weapons and such ornaments as the Phœnician merchant sold to the Homeric-Greeks. Those who well study the Iliad, acknowledge a truthfulness in its drawings, which is the best seal of its antiquity, an antiquity not forged by Pisistratus, or in any later times. Those may who like believe there never was a Homer, or that there were many, but that the Iliad is a work of the time it holds forth to be, no well-thinking man will deny. To be able to feel this it is not enough to read the text—it is useless to read the Byzantine commentators or the scholastic commentators of these later times: what we have to study is the remains of ancient art and the relics of modern discovery, and not less those written records we have of those who, in our own day, have been eye-witnesses of all the phases of civilization.

The lump of iron which Achilles gave as a prize in the death-games of his friend, would be of little worth now, though the giver boasted of it as enough to find all the iron a husbandman might want in a long life. In the Museum we have spike nails, so highly thought of, that they are stamped by the maker; some with writing at a great length. A bronze tripod vase or brass kettle given by the same hero, raised the mirth of Voltaire. Such vessels in the Museum show that with the rough tools of the workmen they must have been made with great labour. We must not look through the spectacles of a Voltaire, neither is there any reason why we should read with less interest what Homer has sung of king Agamemnon or Achilles, than what Cook has written of king Terreoboo or of Omai. In the latter case we have the record not a century old, in the former a quarter of a hundred centuries old; yet both are equally fresh, truthful, and pleasing to a healthy mind.

To understand the state of handicrafts among the Greeks and Romans, is to understand the political and social condition of the middle ages, and of those nations which in the present day are most behindhand. In the overflowing of our material wealth we are not ready to conceive how much

the commonest institutions among ourselves are hindered in their progress among people less favoured. The wisdom of those missionaries who teach their people the arts of life first, and religion afterwards, is approved by the evidence of experience. When a great change has been made in the social condition, habits and thoughts of a people by material improvements, they are prepared to receive a great religious change. The old French lady who saw a balloon rise in the air for the first time, sorrowed that she should die before the art of living for ever would be found out. It is the nature of the human mind when struck by one wonder, to look out for others, and to give trust to the powers of him who has created the wonder. It has, however, been well observed that the Christian missionary in the Pacific, beginning in the wrong way, shakes the faith of the islanders in their old worship, without giving them faith in a new worship. A Dædalus, a Cecrops, or a Cadmus, who taught the Greeks a new art, might give them a new belief, or even teach them to worship himself. Among a rough people, little better than wild men in a wilderness, the clever workman became a lawgiver and a god; the use of a saw, the forging of a breast-plate, the weaving of a sail, were means of wealth and power where all others were without skill.

When robbers overran the land and sea, a well hammered helmet, breast-plate, and spear, were among the best goods of every man; the king and the warrior were stronger in their armour than their courage; they trusted more to the dread they raised in their ill-armed foeman, more to the boast of power than the thrust of the sword. When one of Homer's kings fights among the crowd he slays his many, but when king meets king the war becomes a war of words; Hector and Achilles strive which can outboast and frighten the other, and they only meet hand to hand when they cannot help it. The deeds in the Iliad do not come up to the words, and fall far short of our measure of heroism, but they are quite in keeping, and Homer is none the less a true painter of men and manners.

In Case 45 are several helmets, some of which are Greek, made to cover the face, with a nose-piece and slits for the eyes. These are made in one piece without joint, and some of them seem to be cast. The metal is bronze, and the workmanship is good. A phalanx so well armed and thoroughly trained must have formed a powerful force, well able to achieve the battles of Alexander. The work is among the best there is, and it hardly seems as if the light bronze swords could break through the thickness. This gives a reason why the soldiery trusted to the heavy spear and javelin. One of the helmets has a sheath to hold a nodding crest, and others are slightly ornamented. When polished these helmets must have shone brightly in the battle-field, as the poet tells us. There would be no harm in polishing one to show the effect.

In No. 46 are two helmets and a shield, very richly embossed. They might stand in the Tower Museum without being outdone by the finest Milanese workmanship.

In Nos. 42 and 43 are spear-heads, maces, swords, daggers, knives, and arrowheads. From the confusion, it is impossible to separate Greek work from Roman,—though this is not of so much moment, as whatever the Greeks could do the Romans had the advantage of. Rome had all the resources of Egyptian and Greek skill; yet how far was it behind the Rome of these days.

In No. 46 are Roman weights, mostly of a solid bell-shape, with a ring or handle at the top. Some of them are large. There is nothing noticeable in them. There are likewise scales of two kinds, the scalebeam and the pair of scales. The workmanship is good. The remains of Pompeii show that the Roman tradesmen were as well supplied with scales and weights as ours. The Roman weights have enabled antiquaries to ascertain the Roman pound, which is the original of the modern system of weights. Here are some large adze-heads of fair work.

A tripod stand of bronze, in No. 49, is a large and good piece of brass work. It is 2½ feet high. Another is about 2 feet high, and of smaller proportions.

The high tripod stand in No. 50, is a light and pretty design. A frame rests on three sphynxes, each upheld by a caryatid, ending in the curved leg.

The chandelier in No. 51, is a large piece of work. It is for twelve lights, made to hang up in a hall or large room. The trimming of such lights must have been very troublesome. A hook, jointed on to a staple made to fix in a wall, is a good piece of smith's work. The joint is well made. Lamps were hung up against walls by such hooks.

In Nos. 52 and 53 are candelabra and stands. Some of these stands end in hooks, and are made to hold lamps, sauce ladles, &c. They may be called Roman *épergnes*.

In Nos. 54 and 55 are candelabra with flat tops, some 4 or 5 feet high, made to stand on the ground; and others a foot high or so, to stand on the table. The small earthenware and bronze lamps were put on the top of these candelabra. The lamp of the well-known shape, turned in our potteries into a milk jug, could be carried about in the hand, or be used on a candelabrum upon a table, for reading. For carrying about, they are much more convenient than our candlesticks or oil-lamps, which are cumbersome. Unless, however, there were some catch on the top of the candelabrum, to hold the lamp, there must have been fear of its being upset. The short candelabrum and lamp are elegant, and might be imitated.

The bronze lamps are in Nos. 56 and 57, the earthenware lamps in the middle of the room. The bronze lamps are many of them well finished Some of them have lamps by which they can be hung up, either in the middle of a room or on a hook against a wall. The latter seems to have been preferred, as Roman walls were better than roofs. Many of the lamps are table lamps, made to stand flat or on a candelabrum. In these cases are two chandeliers or lamps with eight lights, and one with seven lights. With these chandeliers of seven, eight, and twelve lights, the Romans had full means of lighting large rooms.

The most noticeable article in No. 58 is a bronze cullender or strainer, of seven inches diameter, very well finished, and with the holes cleanly drilled.

No. 59 contains some large copper kettles and basins, some of which are two feet across. Here are many bronze handles, some of handsome design: two of them have a man's head and a woman's head, beautifully chased. A swinging handle is cleverly wrought. There are some small tripod stands, well finished.

In No. 60 are several saucepans of a modern shape, some finished by turning, and some by the hammer. The smith's work is generally not well finished unless turned. This seems to be for want of good files. Where the surface is ornamental the fault is not seen; but a plain surface commonly looks clumsy, like Chinese work.

There are likewise bronze stewpans and fryingpans with handles in No. 61: also pots.

In Nos. 62, 63, and 64, are bronze jugs of various sizes; some of these are engraved, and some ornamented in relief. There are many 18 inches high; some neatly finished, but mostly rough. They are not equal to the pottery. Although the saucepans in No. 60 are finished inside by turning, the lathe does not seem to have been used to the outsides of the jugs; yet it seems quite as easy to have made a chuck for one as the other, and the Roman lathes could take a large and heavy article.

There is some ornamental chainwork in No. 80, much of which is elaborate, but seldom well finished. A large piece of double-linked cable chain, of a watchguard size, is the best. There is likewise a square chain, seemingly plaited with wire. Some of the lamp chain, in Nos. 56 and 57, is also very good. There is not much fancy in the patterns of chainwork. A favourite pattern is a piece laid *wavy*, with a round coil at each end, the *waves* being linked to the corresponding parts of other pieces. This makes a flat chain, used for belts and other purposes. In this case is the rowel of a spur, rather large, but a very good piece of workmanship.

The case No. 98 contains mixed Greek and Roman articles: some of the former from the tomb of a warrior at Athens. There are knucklebones or astragals of various sizes, in glass, metal, and iron, for playing the favourite game of the ancients. There are counters and medals of ivory and bone, but the engraving and finish are not good, except in some of the plain turned ones. The assortment of dice is numerous; they are of glass, metal, wood, and stone; a variety with the corners cut off, and one set with pentagonal faces. Some of these are very large. In this case are likewise counters and ornaments of cut glass. The glass is clear, well and sharply cut.

In Nos. 99 and 100, the articles are likewise Greek and Roman mixed. Here are bone spoons, like common salt-spoons. Bodkins, needles, pins, and hair-pins of ivory and bone, and likewise of metal, are numerous. The eyes of the bodkins and needles are long and well cut, but otherwise they are not neatly finished. The smallest needle is two inches long, and thicker than a darning needle. In metal needles, the eye seems to be made by splitting the head and then welding the ends together, so as to leave a slit for the eye. It seems likely that finer needles were made, but

they must have been very dear. They were perhaps made in a soft state. In this case are small jugs, phials, and vases of coloured glass, made for toilet use. Likewise earthenware imitations, painted or enamelled. The pattern is chiefly a wavy line, each line of a different colour. One phial is to be noticed an inch long, but thick, and of a brown colour with white streaks. It is a very pretty toy. The glass blowing and cutting are good, but do not seem to have been carried out on such a large scale as among the moderns. The specimens in Case 40, found in England, are very good.

The case No. 93, gives some very interesting specimens of Greek wood work, a lyre and two flutes from a tomb at Athens. Each flute has a mouth hole and four finger holes. One flute is of a single piece, about a foot long, and the thickness of a piccolo flute; the other is rather longer. The outside is smoothly turned, and the holes are cleanly bored, seemingly with an auger of the same size. The lyre is much broken.

The contents of Case 86 are mostly Greek. They are small bullæ or balls of glass and stone, chiefly blue. There are some bone bodkins, large but well finished.

In No. 104 are small metal ladles, scoops, spoons, and spatulæ. Here are also a small pair of pincers or tweezers, jointed like scissors, and a fish-hook.

In No. 105 are several pairs of compasses; among them a small pair of carpenter's compasses, four inches long; a pair eight inches long, with jointed legs; and a pair of double compasses. These instruments are not so well finished as in these days, but the joints and workmanship are good. A large assortment of Roman stamps and brands is of various goodness; some very neatly cut. Here are some spike nails, well forged. The staples are good. The hinges are among the most interesting specimens of Roman smith's work. Some are as well finished as can be desired, particularly a large and heavy pair made with a double joint. There are some strong door sockets.

In No. 106 are locks and keys. The keys are very clumsy.

No. 112 contains a variety of signet rings, some with stones set. These are mostly common things, not equal to the jewellery of gold and silver in other cases. A chain or necklace, enamelled gold and blue, is one of the neatest pieces of work in the whole collection. Every piece is of the same pattern, and well linked together.

The assortment of buckles is large. They of all shapes and sizes—square, oblong, round, oval, and horse-shoe among others; some few ornamented, one with two rams' heads. Many are embossed, but badly. A ring buckle, of the size of a shilling, is neatly wrought. The tongue of the buckle is often made of a bit of wire, with the head twisted round. The rivetting is often clumsy. There are buckles made to sew on; one like a good stock buckle. There are many brooches with a spring catch; some very large and clumsy, as if made by common smiths.

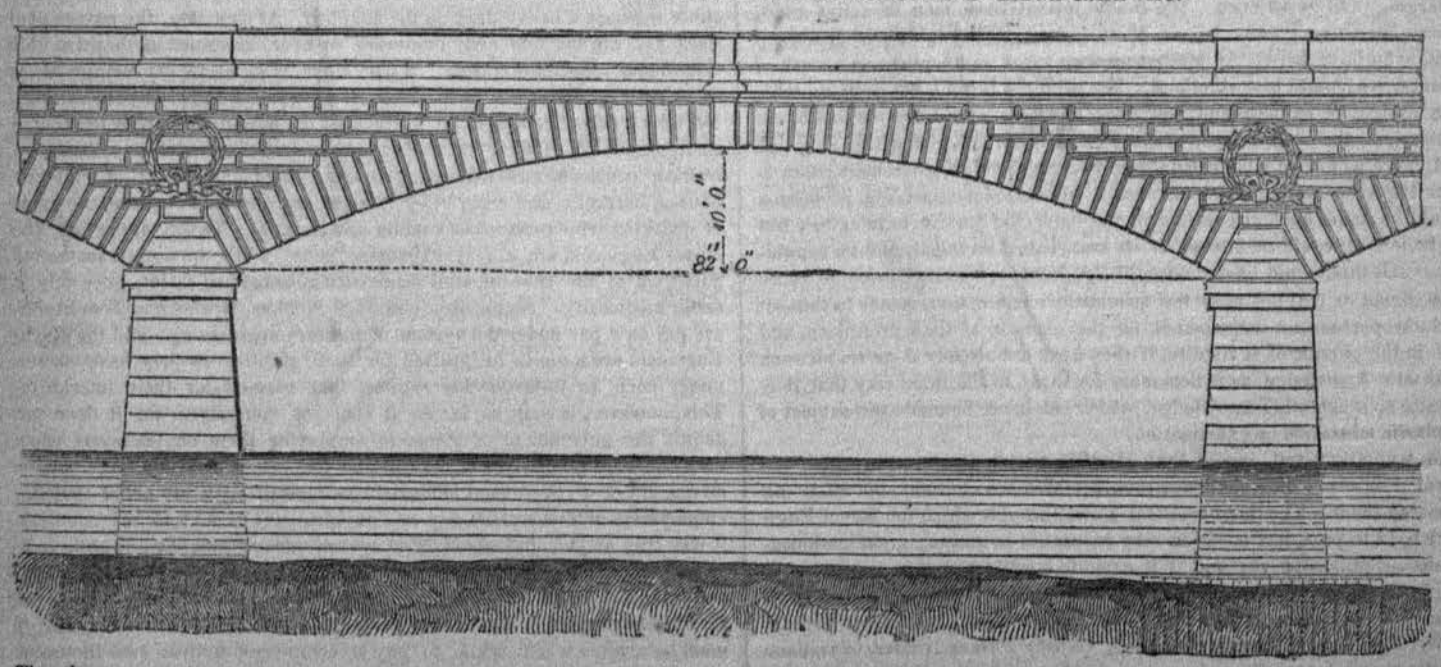
The collection of metallic mirrors and mirror-cases fills several cases. The mirrors are from three to eight inches diameter, and cleanly turned. It is a pity that some of them are not polished, to show the use of them, for most of them are dull and rusty enough now. All the mirrors are made with a handle to hold by, so that some look like fryingpans. Some have their faces and cases engraved, sometimes done in the lathe and sometimes with the graver. The cases are often beautifully embossed or engraved, though some are very common. In No. 74 is a mirror-case of bronze, found at Toscanella. It is nine inches across, and delicately chased in very high relief. Two women are sitting opposite to each other. They are dressed like Pallas Athene, with a Medusa's head and snakes on the breastplate, and a snake on the shield. This case is much damaged. Another case, also found at Toscanella, is five inches across. The subject is Bacchus and Ariadne. Both are naked, Ariadne with her back turned clasping Bacchus round the neck. He holds in his left hand a large wine jar. A panther is behind him. There are several cases engraved in the style of the vases, some with Etruscan countenances. The engraving is mostly a bad attempt at anatomical drawing. In No. 75 all the engraved cases show bad drawing. Here is one mirror-case seemingly cast, which is a piece of beautiful workmanship. It represents Hercules and Omphale, in the early Greek style. The drapery and details are highly finished.

In No. 90 are mirrors from Athens and Ithaca, all of them small.

The above remarks, though they embrace only an imperfect view of the collections in the Museum, may still give some idea of ancient workmanship. It will be seen that they were acquainted with hammering, forging, turning, filing, casting, boring, drilling, rivetting, polishing, tempering, die-sinking, glass blowing and cutting, and enamelling. In many of these they had made much progress. It is impossible to avoid reflecting how much the work of the ancients was limited by their want of power. The difference is great between the mechanical resources of the Romans and what the steam-engine has done for us in the forge-hammer, the saw, the boring, the planing, and the rivetting machines. We cannot, however, help admiring how much they did with small means.

(To be continued.)

STONE BRIDGE OVER THE RIVER MEUSE FOR THE NAMUR AND LIEGE RAILWAY.



The above engraving is the centre arch of a handsome stone bridge now in course of being constructed on the Namur and Liege Railway, over the River Meuse, in France, from the designs of George Rennie, Esq. The bridge consists of five arches, 82 feet span, with a rise of 10 feet; the piers are 8 feet thick at top and 11 feet at bottom, and 24 feet high from the top of the footings to the springing of the arch. The roadway is 26 feet wide to the outside of parapets, and will carry two pairs of rails.

THE GOVERNMENT AND THE RAILWAYS.

Not a month passes but we are urged to take notice of the unfair way in which civil engineers are treated by the government, in the preference given to military engineers in civil employments. We have professed often enough our esteem and regard for our military brethren in their military capacity; but we cannot withhold our belief that they are not the best fitted for civil office. Whether we go by theory or whether by facts, we come to the same end,—that as civil engineers the military have not shone, neither are they likely to do so.

We may be told that the Royal Engineers have the guarantee of a good collegiate education—nay, further, that they are the picked men of a large body of students, of whom the least endowed are left for the Royal Artillery. This may seem a guarantee of qualifications, as against a profession, that of the civil engineer, which is an open one and subject to no examination. It is tolerably certain that there are very many civil engineers far below members of the Royal Engineers in knowledge;—but here we come to a stop, because we do not get the converse of this proposition. We have no hesitation in saying—nay, in laying down a challenge, that the body of civil engineers has exhibited a much greater degree of knowledge and of talent than that of the Royal Engineers. A preliminary examination might keep out many men of inferior attainment; but with the civil engineers it would have this disadvantage, that it would keep out many men of superior attainment. Being an open profession, civil engineering is always receiving the accession of large numbers of men, whose general proficiency and abilities make them valuable associates; but who might be either unable or unwilling to pass a schoolboy examination. These recruits include many men of middle age, or of mature age, who have already gained reputation in their previous career, and who bring it for the enhancement of their new profession. If others, either from sheer impudence or from an over-estimate of their own qualifications, likewise dub themselves civil engineers, it does not matter; for neither will professional men give them countenance, nor the public give them employment. This is the real censorship of the engineering profession, and it is one much better than a scholastic examination, which at the best can be got through by a short grinding, and the matter of which is, in all likelihood, forgotten everafter.

Subject civil engineers to a preliminary examination, as many in their zeal have proposed, and what must be the consequence? We should lose all those men who are most valuable, and on whom we most pride ourselves. We shall first exclude those most practical men, who begin their career as mechanics, and who so often rise to the highest distinction. The workshop will at once be closed as a nursery for engineering. We shall likewise lose those who being engaged in mining, in draining, in shipbuilding, and in factories, have enlarged their sphere of operations by enlarging their experience. We should lose all those men of active mind, whose inventive genius is our great glory. We might, perhaps, keep those who have begun as mathematicians; but, in keeping one branch of science, we should lose all others. We need not begin a list of those who, if a system of examination had been adopted, would now be lost to the profession: the acquaintance of every one will furnish him with a long list, and there would be more difficulty in deciding who would remain, than in deciding who would be struck out. What the engineering profession would be under such circumstances we leave the public to imagine; but we believe it would be filtered of its knowledge, its talent, and its reputation. All this would be done needlessly, because the exclusion of those who cannot or will not pass the scholastic examination, comes to this—it excludes persons not incompetent for the exercise of their profession, and who in the pursuit of it acquire, if they have not already done so, all such scholastic knowledge as is necessary for them, in the same way that they acquire so much other knowledge, which can never be made the subject of scholastic education or examination.

On whatever point, except that of military engineering, on which the Royal Engineers can challenge their brethren the civilians, the latter can outmatch them. The mathematical sieve through which the Royal Engineers have to pass, has not been very successful in making great mathematicians or philosophers; and if it came to a contest on this point, we can supply the military with plenty of champions well able to contend with them. Messrs. George Rennie, Eaton Hodgkinson, John Scott Russell, Robert Stephenson, Isambard Brunel, George Parker Bidder, Wyndham Harding, and Joseph Samuda, are well able to compete as philosophers or mathematicians; and here we have only put down such names as most readily occurred to us, without taking the trouble to choose the most proficient, or even to put down all those who are well deserving of being named in such an enumeration.

If attainments are to be known and shown by their exercise, an advocate for the Royal Engineers would have little to show for them. The civil engineers have been greater contributors to the cause of science, as much as they have been greater contributors to professional literature. The works on professional subjects by officers of the Royal Engineers, who have the best means, are few; and even the volume of "Transactions of the Corps of Royal Engineers" is eked out by civil contributions.

The examination is no guarantee of the superiority of the Royal Engineers, for it is no guarantee against mediocrity in that body. If the practice of their profession be a claim of the Royal Engineers as against civil engineers, we ask what are their works? We know what civil engineers have done; but neither the public nor ourselves know what the Royal Engineers have done, unless it be the Rideau Canal, which cannot be considered as the most flattering testimonial of success. We can show too that their recent career in connexion with the Board of Trade has not been such as to raise them in the eyes of the public.

Before saying more on this latter point, we are tempted to enquire on what grounds military engineers should be at all employed in a civil capacity. We know of no reason why civil engineers should not be so employed. When the two bodies are considered in connexion, all impartial persons will acknowledge that civil engineers are far superior in knowledge, talent, and reputation, as much as in the works they have executed. Indeed, nothing can be said in favour of the military engineers. The government, however, have tried civil engineers, and have not found them wanting. If our dockyards are examined, we shall vainly seek for proofs of the capacity of the military engineers. The works and machinery, on the other hand, give ample proof of skill and ingenuity other than military. Whether breakwater or block machine, whether steam engine or lathe—whatever is best, whatever is cleverest, is by other hands than those of the military.

When civil engineers are sent on missions of enquiry by the government, we are sure they have not been behind their military brethren. No one, we believe, will deny that Mr. James Walker, Mr. William Cubitt, and Mr. Hodges have proved quite as good commissioners as Sir Charles Pasley, Sir Frederick Smith, and Captain Coddington; although the latter have rarely acted out of harness, or without Mr. Airy, Professor Barlow, Mr. Amsinck, or somebody else, being attached to them, to help them through their work.

Why a military engineer should be employed at all in a civil capacity we cannot comprehend: the public never think of so employing them until they have had a good civil training; and we know of no reason why the government should do so. We cannot believe that it is on the ground of cheapness, for we do not consider the Royal Engineers as cheap—we think they are a heavy drag on the country. At any rate, the government does not always find civil engineers so dear, inasmuch as they are able sometimes to employ them. When Royal Engineers are employed as railway commissioners, or for other civil purposes, they are paid salaries, but which do not represent the burthen on the nation. There is the cost of their education, of their training as juniors, of their sick-pay, half-pay, retiring pensions, and widows' pensions, besides the cost of colleges, houses, barracks, and many other items of considerable expense, the mode of charging which cannot be readily ascertained. Taken altogether, the Royal Engineers are a very expensive body, while the outlay, instead of going, as in the case of civil engineering, to reward talent, goes only to foster mediocrity. Stephenson and Jack Noakes, Brunel and Tom Styles, are put on a par under the system of military engineering; and the Royal Engineers are more to be praised for such abilities as they have shown under such an unfavourable *régime*, than blamed for their inferiority. This, however, is only so far as it concerns themselves, for it does not acquit the government of blame in employing them on occasions when they can avail themselves of the superior services of civilians. We believe no one out of a government office deludes himself with the belief that the employment of General Pasley was any financial benefit to the country; it was only an encouragement of a system under which men of ability, or of no ability, are brought up to be made Inspectors-General of Railways, and then shelved off on half-pay, at length to be pensioned off. Whenever Sir Charles Pasley or Sir Frederick Smith is paid one thousand a-year, it must be always worth while to pay a competent civilian two thousand a-year, for money would thereby be saved.

At whatever class of works we look—railways, canals, harbours, docks, or bridges; at whatever class of machinery, we find all constructed by

civil engineers—no one class claimed by military engineers, and no one great work which bears their name. Assuredly, therefore, the standard of qualification belonging to the Royal Engineers cannot be a material one; we have shown that it cannot be on their scientific or literary attainments; and we do not know, in fact, upon what it rests.

The employment of military men in civil affairs is usually held to be ill advised, because from their training they are not suited for such pursuits. From the peculiar nature of their employment and associations, they do not acquire business habits or ideas, and we have always esteemed it unfortunate when they were placed in civil positions, because they have been utterly unable to respond to the call made upon them. The removal of Major-General Pasley from the office of Inspector-General of Railways, is one objected to by himself, and on which he has pursued the extraordinary course of appealing to the public. It shows that there is no sympathy between him and the government. The employment of military engineers brings them in comparison with their civil brethren, who are particularly well trained in matters of business, and who hold their ground among the acutest men of business in the country. The most important and complicated affairs are left to the negotiation or arbitration of Mr. Robert Stephenson, M.P., Mr. Brunel, or Mr. Locke, M.P., by capitalists fully capable of appreciating their practical abilities. It will be found that the engineers have taken as great a part as any class in the organization and development of the railway system and its administration.

So far from exhibiting any such public proof of their capacity, military men are well known to be unfitted for the understanding of business matters. A lad is taken from school, sent to Woolwich, gets a commission, is employed at home or in the colonies, and at length is made a railway inspector, without knowing as much of business as any young man in the city of London. He can give orders to sergeants and corporals, build barracks in places where he has it all his own way; but as to any useful intercourse with society, it is perfectly out of the question. He has not, in most cases, that association with professional and practical men, which might put him in the way of acquiring a proper degree of professional experience. A pupil in Mr. Stephenson's office knows very much more.

It would be very hard for the Board of Trade to furnish the public with any sufficient justification for appointing aged or middle-aged gentlemen, tricked out in blue, gold, and scarlet, as inspectors of railways, of which the inspectors know nothing. It may very well happen that an officer, who has spent his time in New Zealand, or the Isle of Ascension, or in the backwoods of Canada, building barracks and convict jails, may be perfectly guiltless of knowing what a railway is; and it is no reflection upon the unfortunate individual who is made a railway inspector, that he should know nothing about them. Major-General Pasley has the rare merit among military engineers of having written on several professional subjects; but no one ever thought of his knowing anything of railways, until he was brought forward to be the arbiter between Stephenson, Brunel, Locke, and Cubitt, as Inspector-General of Railways. General Pasley could scarcely refuse accepting the appointment, though it put him in the very painful position of interfering with the master-minds of the world in matters of which he knew nothing at all. This position must have been one very painful to Sir Charles Pasley's feelings, and every one will sympathise with him, for his own merits and his gentlemanly conduct have secured for him much good will. The government cannot, however, be pardoned for putting him in a false position. The same is to said of the other gentlemen, who were similarly ill-used.

The appointment of raw soldiers to inspect railways made engineers and directors familiar with their ignorance and incompetency. As they did not understand anything about railways, they had to be taught. Some of them were conscious of their ignorance, very willing to learn, and taking much trouble to learn; others, in the supercilious arrogance and self-conceit engendered in the atmosphere of a barrack-room, have rendered themselves ridiculous by the exhibition of their ignorance on points of which they supposed themselves well informed. How many of our readers have been witnesses of their follies, and have laughed at the presumptuous incapacity of the Mentors set over them by government! Not even an engine-driver can be brought to hold a favourable opinion of men, of whose emptiness he is well aware. The visit of a government inspector is a joke, which nothing but the prudence or good sense of the railway authorities prevents from being made sensible in a manner very undignified. The public, too, and the public press want faith in government inspectors, and the *Times* and *Punch*, the two magnates of the pen, have held them up to well-deserved ridicule.

The officers of the Royal Engineers, and other parties employed by government for railway purposes, use the employment for their own convenience; and if they happen to learn anything, turn their knowledge to account by going into the service of the railway companies. So long as they are worth nothing, the government is at the cost of keeping them, and has to pay for their blundering out of the public purse, and to encounter the ridicule of their incompetency; but when the officers are worth anything, they sell their knowledge in the best market.

Anything so unsatisfactory as the position of the railway officers of the Board of Trade, and their relations with railway companies, can scarcely be imagined. Some needy son of patronage, who has scraped through his examination at Woolwich, and who is always more of a dandy than a gentleman, and more of a schoolboy than an engineer, gets into the railway department. He is dependent upon the chairmen, secretaries, superintendents, and engineers not to expose his ignorance, and to give him the information he wants. He gets very sociable in his intercourse, and very familiar—for many of his associates are much better gentlemen than himself, and none is ready to give way to assumptions of barrack superiority. On being brought in contact with the world, free from the hallucinations of mess pomp and self-conceit, he finds out his own true position, apart from his butterfly livery, that he is a nobody, and rather a poor one. He wants the means to keep up his own dandyism and his wife's millinery, and he wants places for his sons and portions for his daughters. The ambition to live a useful life comes upon him, and he cannot resist the temptation of asking for the first railway appointment which comes in his way.

Some very honourable men may do their best to withstand corrupt action; but at any rate the government officer is placed in a false position, and cannot give satisfaction to his employers. Some, it may be, give way to positive corruption—nay, suggest and carry it out; and at any rate, those who do not give way lie open to the imputation of it. The events of 1845, and the parliamentary discussions on the conduct of the Board of Trade, will occur to every reader, and the result of them cannot by any means be considered as satisfactory.

For a public officer to be suspected is always bad, because when honest it trammels his own mode of action, and the jealous public will never be satisfied of the independence of the officer, when they know how readily he may turn his trust to his own private purposes. The communication of valuable information may so easily be made a matter of profitable barter and speculation, that the public can never be satisfied it is not done, and unfortunately before now circumstances strongly corroborative of suspicion have occurred. The public have every regard for the honourable character of military men; but it does not esteem the character of one profession, or of one body of gentlemen, as higher than another; and at any rate it does not judge very favourably of human nature when exposed to temptation.

The Board of Trade officer, when once determined to place himself out, has the means of preparing the way by rendering such services to his future employers as may well be considered the price of his employment. How easy it is for one so determined to make such arrangements for the favoured line, and to make such reports upon it, as may be very valuable to the company, and in the end very valuable to himself, but which cannot in any way be held as the best means of forwarding the public interests. This is certainly a possibility—nay more, it has a probability, and there are those who believe that it really has occurred, while there is no guarantee that it may not occur over and over again.

The temptation to companies of using parties connected with the Board of Trade is very strong, as they not only get an immediate service done, but they also have the means of communication whenever they may want it.

Often as the Board of Trade have been subjected to public censure, we are not aware of any defence which has been made for them—we might say of any defence which can be made. The railway department is utterly useless for the purposes intended; its inspection is a joke, which is now so well known, that it ceases to tranquillise the public mind; and it is only operative for mischief. The department is an incubus on the railway interest, which does not give patronage enough to a government to justify its continuance, and which is well calculated to bring a ministry into jeopardy. In the first session of a parliament in which a railway interest will be combined, Mr. Strutt is pledged to bring forward a bill, which has been denounced as an aggression on a vast amount of private property; and this railway directors have determined to resist to the utmost. With the number of new and hostile members in the house, the defeat of Mr. Strutt by the railway interest, assisted by the opponents of the ministry, is one among the disasters of the next year which appears most likely to be accomplished,

and which will greatly aggravate the difficulties with which the administration of Lord John Russell is already threatened. A blow once given, we hope the railway interest will not rest till they have swept away every vestige of interference.

TEMPERATURE OF STEAM.

Sir—The following empirical formula for determining the temperature of steam is new, accurate, and may be interesting to some of your readers.

If n = the number of atmospheres, then

$212 + \frac{72}{2} + \frac{72}{3} + \frac{72}{4}$, &c., till $\frac{72}{n}$ = the temperature in degrees of Fahrenheit. Thus, for

Atmospheres.

$2 = 212° + \frac{72}{2} = 248$
$3 = 212° + \frac{72}{2} + \frac{72}{3} = 272$ or $= 248 + \frac{72}{3}$
$4 = 212° + \frac{72}{2} + \frac{72}{3} + \frac{72}{4} = 290$
$5 = 290° + \frac{72}{5} = 304{\cdot}4$
$6 = 304°{\cdot}4 + \frac{72}{6} = 316{\cdot}4$
$7 = 316°{\cdot}4 + \frac{72}{7} = 326{\cdot}7$

The following are the results of Dr. Ure's experiments, and those of the Franklin Institute, as far as ten atmospheres, contrasted with the results obtained by this method of calculation:—

No. of Atmosphere.	Calculated Temperature.	Dr. Ure's Calculation	Mean of Temperature obtained by Franklin Institute.
1	212°	212°	212
2	248	248	250
3	272	272	275
4	290	290	291·5
5	304·4	305	304·5
6	316·4		315·5
7	326·7		326
8	335·7		336
9	343·7		345
10	351		352·5
11	357·5		
12	363·5		
13	369		
14	374		
15	379		
16	383·5		
17	388		
18	392		
19	395·5		
20	399		

I am, Sir,
Your obedient servant,
William T Matier,
Civil Engineer.

Dublin, October 16, 1847.

MEASUREMENT OF ANGLES.

How to lay off an Angle of any number of Degrees, Minutes, &c., with Compasses only, without the use of Scale or Protractor.

By Oliver Byrne.

First allow me to correct a trifling mistake involved in the solution of the converse of this proposition, published in the *Journal* of last month. Page 313, col. 2, line 10, for " + 1 or − 2," read " + 1 or − 1;" and the expression (Q) becomes

$$\theta = \frac{n q \pi}{m n q \pm q \pm 1}.$$

The same correction must be made at page 314.

Let it be required to lay off an angle of $36° 40' = \beta$.—Take any small opening of the compasses less than one-tenth of the radius, and lay off any number of equal small arcs, from A to 1; from 1 to 2; from 2 to 3; &c. (fig. 1), until we have laid off an arc, A B, greater than the one required.

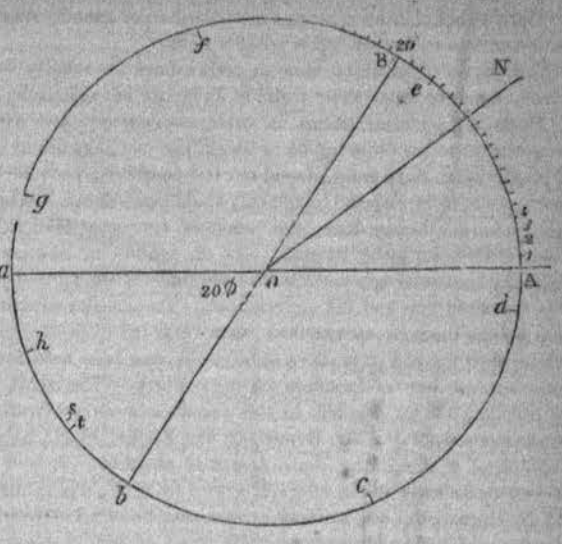


Fig. 1.

Draw B b through the centre O, then will the arc $a\,b$ = arc A B, which we shall put = $20\,\phi$ in this example, and proceed to measure $a\,b$ as in example fig. 5, page 314. Lay off $a\,b$ from b to c; from c to d; from d to e; from e to f; from f to g. Putting $g\,a = \Delta_1$, then

$$6 \times 20\,\phi + \Delta_1 = 360° = \frac{108}{11}\beta; \text{ because}$$

$$\frac{360°}{36° 40'} = \frac{21600}{2200} = \frac{108}{11}.$$

Lay off, as before directed, $g\,a$, $= \Delta_1$, from a to h, from h to s, and b to t; then calling $s\,t$, Δ_2, we have

$$3\,\Delta_1 + \Delta_2 = 20\,\phi;$$

and we find that $s\,t$ is contained 28 times in the arc $a\,b$;

$$\therefore\ 120\,\phi + \Delta_1 = \frac{108}{11}\beta;\ 3\,\Delta_1 + \Delta_2 = 20\,\phi;\ \text{and } 28\,\Delta_2 = 20\,\phi.$$

Eliminating Δ_1 and Δ_2, we find

$$\beta = \frac{29205}{2268}\phi = 12{\cdot}9 \text{ times } \phi \text{ nearly};$$

$\therefore$ 36° 40′ = ∠ A O N is laid off with as much ease and certainty as by a protractor.

As a second example, let it be required to lay off an angle of 132° 27′.—From 180° 0′ take 132° 27′ = 47° 33′, which put = β.

$$\frac{360°}{47° 33'} = \frac{2400}{317} \text{ when put } = \frac{\nu}{\delta}, \text{ then } \frac{\nu}{\delta}\beta = 360° = \pi.$$

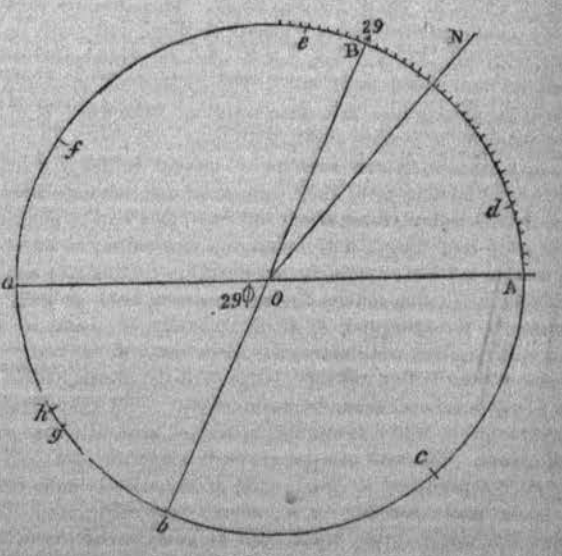


Fig. 2.

Referring to fig. 2, we have laid off 29 small arcs from A to 29 = e. A B = $a\,b$ = $b\,c$ = $c\,d$ = $d\,e$ = $e\,f$. And $a\,g$ = $b\,h$ = $a\,f$ = Δ_1; $h\,g$ = Δ_2.

$$\therefore 5 \times 29\varphi + \Delta_1 = 360° = \frac{\nu}{\delta}\beta = m\epsilon\varphi \pm \Delta_1 \qquad (1)$$

$$2\Delta_1 - \Delta_2 = 29\phi, \text{ or } n\Delta_1 \pm \Delta_2 = \epsilon\varphi \qquad (2)$$

$$13\Delta_2 = 29\phi, \quad \text{or} \quad q\Delta_2 = \epsilon\varphi \qquad (3)$$

Eliminating Δ_1 and Δ_2, we have

$$\beta = \frac{\{mnq \pm (q \mp 1)\}\epsilon\delta}{\nu nq}\phi = \frac{\{5.2.13 + (13+1)\}\,29.317}{2400.2.13}\varphi = \frac{1323792}{62400}\varphi = 21\tfrac{1}{4} \text{ times } \phi \text{ very nearly.}$$

Hence the line O N determines the angle a O N = 132° 27′.

In the expression

$$\beta = \frac{\{mnq \pm (q \mp 1)\}\epsilon\delta}{\nu nq} \qquad (R)$$

substituting the numerals of the first example, then

$$\beta = \frac{\{6.3.28 + (28-1)\}\,20.11}{108.3.28}\phi = \frac{29205}{2268}\phi = 12{\cdot}9 \text{ times } \phi \text{ nearly, the result before obtained.}$$

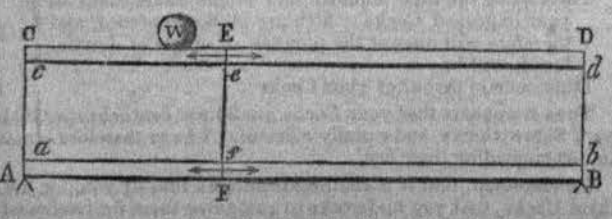
The ambiguous signs of (R) cannot be mistaken or lead to error, if the manner in which it is deduced from (1), (2), (3), be attended to. From (3) $\Delta_2 = \frac{\epsilon\varphi}{q}$; substituting this value of Δ_2 in (2),

$$\Delta_1 = \epsilon\phi \mp \Delta_2 = \epsilon\phi \mp \frac{\epsilon\phi}{q}; \text{ which, when substituted for } \Delta_1 \text{ in (1), gives}$$

$$\frac{\nu}{\delta}\beta \quad m\epsilon\phi \pm \left(\epsilon\phi \mp \frac{\epsilon\varphi}{q}\right); \text{ from which (R) is easily found.}$$

ON MODEL EXPERIMENTS.

Until this present era of the "railway and the steam-ship and the thoughts that shake mankind," the studies of the engineer, like those of the lawyer, were confined to the acquiring of details of precedent, while the knowledge of the scientific principles of his profession was neglected as of comparatively little importance. Thus, although the recognised modes of construction were numerous, the laws of structural equilibrium were few and but imperfectly developed; the builder was satisfied if the edifice he was about to raise were similar in character and magnitude to others which had been raised before;—this fact at least he knew—they had been found to stand, perhaps for ages; and the most ordinary, *pariter paribus*, style of reasoning might be sufficient to assure him that his own work would be no exception to the general rule. But with the railway arose a new epoch in the history of engineering: works were required to be constructed of unprecedented magnitude and solidity, and for the execution of which a higher amount of mechanical science and a wider range of experience were required. To supply the latter of these two desiderata, numerous experiments have been conducted of late years on the strength of materials, and on models of the whole or most important component parts of proposed structures. It is to these last class of experiments we would now direct the reader's attention, particularly with reference to the difference of amount of thrusts and strains in the model and its original. We shall first consider the case of a simple horizontal girder, composed of a web and an upper and lower flange, and loaded with a given weight;—to this case may be referred almost all the cast iron railway bridges now completed, as well as the proposed tubular Menai Bridge.



Let A B be the girder, supported at A and B, and composed of the lower flange A B ab, the upper flange C D cd, and the web $cabd$. Let A B = au; A C = bu; A a = cu; C c = du; C w = hu.

Let the weight at $w = wu^3$ (because the weight varies as the cube of the scale u); the weight of beam and girder = $w'u^3$; C E = lu; R and R′ the reactions at A and B.

Then first considering the equilibrium of the whole girder, we shall have

$$R + R' = (w+w').u^3$$

$$R'.au = \left(whu + \frac{w'au}{2}\right).u^3; \text{ the girder being supposed uniform and symmetrical throughout its mass.}$$

$$\therefore R = \left\{w\left(\frac{a-h}{a}\right) + \frac{w'}{2}\right\}.u^3.$$

For the equilibrium of the portion C F, if T be the tension and thrust of the lower and upper flanges, Y the vertical force at F, z the distance between the points of application of the thrust and tension, we have

$$T = T; \quad Y + R = \left(w + \frac{l}{a}w'\right).u^3; \text{ and}$$

$$Ylu = \left(whu' + \frac{w'.l^2u}{2a}\right).u^3 - Tz.$$

$$\text{Whence } Tz = \left\{\left(\frac{a-l}{a}\right).hw + \left(\frac{a-l}{2a}\right).lw'\right\}.u^4.$$

Now, in applying the results of experiments upon a model girder to its original, all we have to do is to vary the scale u from the scale of the model to the scale of the original. Consequently, we find that Tz varies as the fourth power of the scale or dimensions of the girder. If the web of the girder be very thin compared with the breadth of the flanges and their vertical depth,—and if their vertical depth, uc, ud, be small compared with ub, —and if uk, uk' be the width of the upper and lower flanges respectively,— t and t' their thrusts and tensions per square inch respectively—then we shall have

$$T = tkcu^2 = t'k'du^2 \text{ nearly; and } z = au \text{ nearly.}$$

$$\therefore Tz = takcu^3 = t'k'ad u^3 \text{ nearly.}$$

$\therefore$ t and t' both vary as u nearly; that is, approximately, *the tension per square inch on the lower flange, and the thrust per square inch on the upper flange, of all similar and similarly loaded girders varies as their scale of linear dimension.* This we consider so important a fact, that we shall endeavour to give a proof of it in popular language.

Suppose a vertical section made of a loaded girder at E F; then supposing F the fulcrum about which the mass A E is turned,—A E will be prevented from turning about F by the opposite action of the tension at F and reaction at A, and the weight w and thrust at E, and the weight of A E collected at the centre of gravity of C F. Now the weight w, the weight of C F, and the reaction at A, will all vary as the cube of the dimensions of the girder, if we suppose the girder loaded proportionally to its mass. And the leverage of these forces varies as the linear dimensions of the girder; consequently, their moment about F varies as the fourth power of the dimensions of the girder; therefore, the moments of the tension and thrust at F and E, vary as the fourth power of the dimensions of the girder; therefore, if we suppose A a and C c small, the tension and thrust vary as the cube of the scale; but as the tension and thrust are composed of the sum of all the tensions and thrusts per square inch at a vertical section of the flanges, and as the area of this vertical section varies as the square of the scale,—in order to make up the fourth power, we must have the tension per square inch varying as the scale u.

We next propose to determine the amount of the load Vu^3 which can be supported at the centre of a girder of the dimensions u, in order that t and t' at the centre may be the same as in a girder of the dimensions $u = 1$ supporting a load w at its centre. We have proved $Tz = Ctu^3$, where C is some constant independent of u.

Making $l = h = \frac{a}{2}$ we have, therefore,

$$Ctu^3 = \left(\frac{Va}{2} + \frac{w'a}{4}\right)u^4;$$

$$\text{and } Ct = \left(\frac{wa}{2} + \frac{w'a}{4}\right);$$

$$\therefore \frac{wa}{2} + \frac{w'a}{4} = \left(\frac{Va}{2} + \frac{w'a}{4}\right)u$$

$$\therefore 2V = \frac{2w - (u-1).w'}{w}$$

$$\therefore 2Vu^3 = \left(2w - (u-1).w'\right).u^3.$$

If $(u-1)\,w'$ = or exceed $2\,w$, it follows that the girder in scale u will not be able to support any weight at its centre, without the tension and thrust per square inch being increased.

Example.—A model girder, length 80 feet, weight 10 tons, breaks with a weight of 30 tons in the middle: what weight will break a similar girder 480 feet long?

$$W u^3 = \frac{(2w-(u-1)\,w')\,u^2}{2} = \frac{(60-50).36}{2} = 180 \text{ tons. } \textit{Ans.}$$

We have been especially induced to call our readers' attention to the subject of model experiments, from the fact that the proposed tubular bridge over the Menai Straits is to be constructed, as to its dimensions, according to laws developed in a series of experiments, conducted by Mr. Hodgkinson at Blackwall. We much fear that the enormous width to be crossed without a support will prove too much even for the known ingenuity of Mr. Stephenson. If, however, the talents of that illustrious engineer should prove equal to the magnitude of his conception, none will feel more satisfaction than ourselves at his success; and with mingled wonder and pleasure shall we witness—at a respectful distance—his aerial tunnel quivering and bending beneath a load of "moral agents," happily unconscious of the laws of equilibrium and of the depth of the cold dark waters above which they are being whirled.

(To be continued.)

REGISTER OF NEW PATENTS.

NASMYTH'S PATENT SCREW COCKS.

The accompanying engravings show an important improvement in sluice cocks, as patented by Mr. Nasmyth, of the Bridgewater Foundry, near Manchester. In consequence of the facility with which they are manufactured, the cost of them is considerably less than that of the ordinary sluice cocks, and at the same time they appear to us far more effective; but the following testimonials, coming as they do from gentlemen well known as practical hydraulic engineers, will show the value of the cock far better than anything we can write.

Fig. 2.

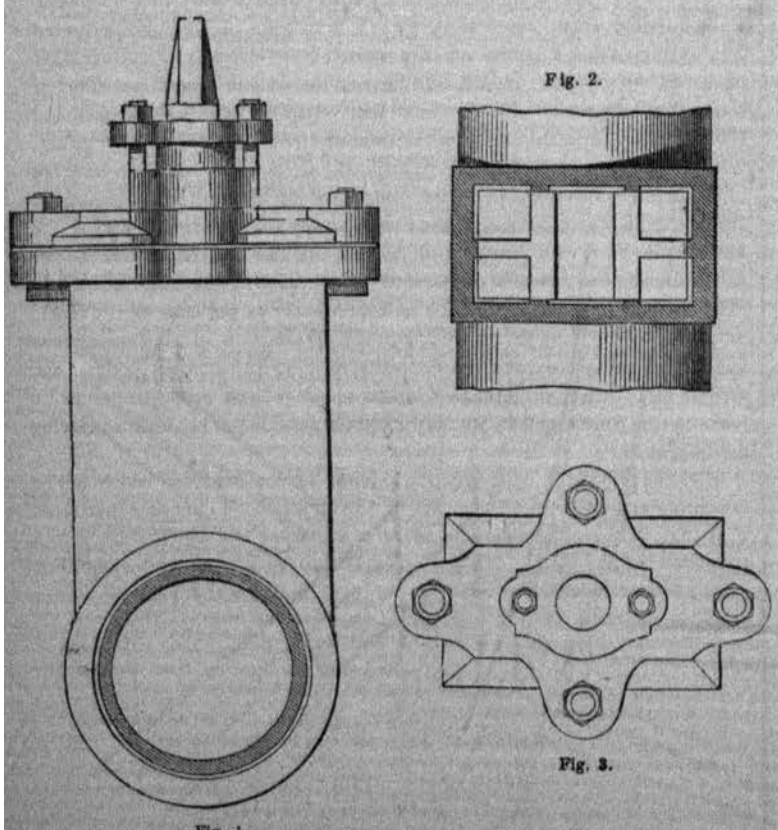


Fig. 3.

Fig. 1.

Fig. 1 is a side view of one of the cocks; fig. 2, plan above the level of the pipe; fig. 3, plan of cover; fig. 4, a transverse view; and fig. 5, a sectional elevation of a cock fully open,—the dotted lines show the position of the valve when closed.

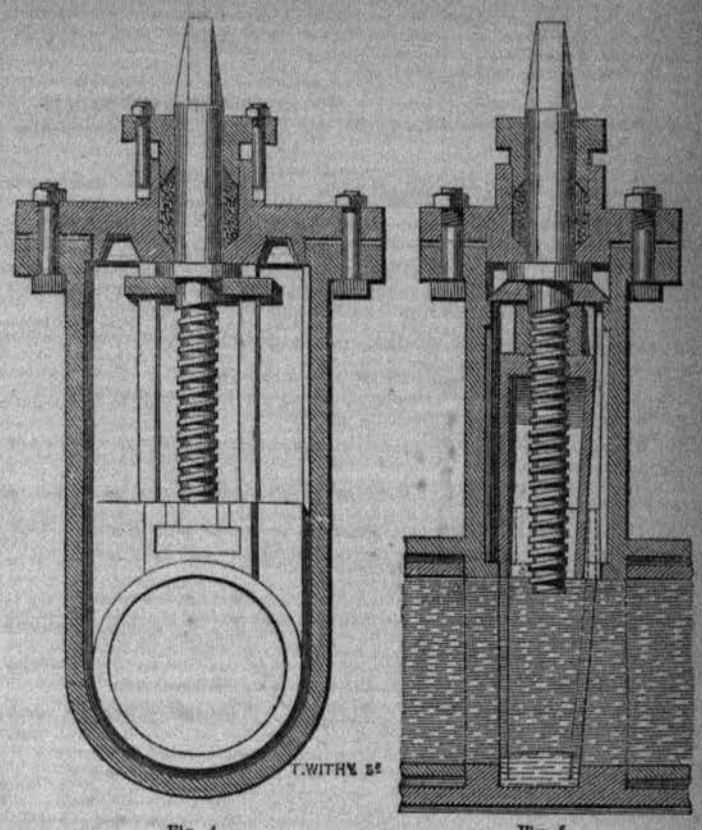


Fig. 4. Fig. 5.

Mr. Nasmyth claims as new—1st. The valves being formed with double faces; 2ndly. The screw passing down through the valve; and 3rdly. The casting of the cock in one piece.

(To Messrs. Nasmyth, Gaskell, and Co.)

Gentlemen,—I have great pleasure in complying with your request, to give an opinion upon Mr. Nasmyth's Screw Cock for Water Works. I have examined and proved two of the cocks, and am quite satisfied that they will answer, in an efficient manner, all the purposes for which this kind of Cock is intended.

One important feature in your Cocks, as distinguished from those ordinarily used, is, that they are *all* double-faced, and therefore, there is no occasion to have two sets, one single-faced, and one double-faced, and the cost is considerably less than that of the ordinary single-faced Cocks, which are cheaper than the double-faced.

Screw Cocks form no inconsiderable item in the first and annual expenditure of a Water Works, and not unfrequently a single-faced Cock is introduced, on account of its cheapness, where a double-faced would otherwise be preferable.

A comparision between the cost of your Cocks, and of ordinary, single, and double-faced Cocks, in equal proportions, should be made in order to show the superiority of yours in a commercial point of view, which, after all, is the most important view to be taken in the introduction of improvements.

	£	s.	d.
The value of Seven single-faced Cocks, of the ordinary constructions, and of the following sizes, viz.—3, 4, 5, 6, 7, 8, and 9 inches, will be	43	18	0
The value of the same number, and of the same sizes, of double-faced Cocks, of the ordinary construction, will be	48	13	6
The mean cost of the two classes	46	5	9
The cost of the same number and of the same sizes of your improved Cocks, which are all double-faced, and therefore will answer the purpose of single or double faced, will be	31	15	0
Difference in favour of your Cocks	14	10	9

Thus it appears that your Cocks are 30 per cent. cheaper than the ordinary Screw Cocks, and equally efficient. I have therefore great pleasure in recommending their use.

I understand, that if a contract is entered into by you, for the supply of these Cocks, that you undertake to guarantee them for twelve months after they have been placed in the ground, and to take upon yourselves the responsibility of all costs and charges which may be incurred should any of them prove defective during that period, and further, that your prices

include also the cost of delivery upon the Companies' Works. These conditions I always introduce into my specifications.

You may make any use you please of this letter, my object being in this, as in all other instances, the introduction of an article cheaper than those ordinarily in use, and equally efficient; and thus to reduce the expenditure in Water Works' Establishments.

I am, &c.,
THOMAS WICKSTEED,
Engineer.

Engineers' Office, Old Ford,
Nov. 18, 1843.

(To Messrs. Nasmyth, Gaskell, and Co.)

Gentlemen,—In reply to your request, I will gladly bear testimony to the superiority of your Wedge Cocks over any other form with which I am acquainted; and I think they might be employed with advantage not only for Water Works, but also for many other purposes. As you desire it, I beg to offer the following observations in support of my opinion.

1st. Your Cocks cost considerably less than the common single-faced Cocks.

2nd. The form insures both strength and durability.

3rd. They are tight, and as the attrition or wear is equal at every part of the faces, I think they will remain so.

4th. Being double-faced, they will stop the water either way, which is a great advantage.

5th. The stuffing-box may be packed without shutting off the water, or emptying the mains.

6th. If, as I suggested, they should now be made with a simple Nut, instead of the Gland, the packing in the stuffing-box can be screwed up at any time, without opening the ground.

7th. The ordinary sizes employed for Service Cocks, even under a pressure of 150 feet, are very easily opened and shut; after the first few turns they may be moved without the aid of a bar, but simply by applying the hand to the key; should the pressure be great, it may be partly balanced by causing the water to act against the taper side of the slide.

8th. As a consequence, the keys carried by the Turncocks may be made much lighter than they generally are.

9th. As we can at all times depend upon your Cocks, being assured they will not allow the water to pass, I can rely, with confidence, upon the indication of my Instrument for discovering faults in the Pipes.

I may mention, finally, that your Cocks also possess the advantages common to some others, such as a free uninterrupted Water-Way; opening and shutting gently and gradually; standing low, so that they may be employed even where the Pipes are near the surface; &c.

It appears to me that there is but one objection which may be urged against them, which is the probability of the faces rusting or corroding. If they were seldom opened or shut such an effect might take place, but if used frequently I consider there is no risk. I have this day examined a Cock put down in August, 1845, and I found it in excellent condition, with no appearance of injurious corrosion.

I will but add, that you are at liberty to make any use you please of this communication.

I remain, &c.,
MICHAEL SCOTT,
Engineer.

Liverpool Water Works,
February 4, 1847.

PIGMENTS OR PAINTS.

JAMES MURDOCK, of Staple-inn, Middlesex, for "*an improved mode of preparing and employing certain colours and materials for painting.*" (A communication.)—Granted March 10; Enrolled September 10, 1847. [Reported in the *Patent Journal.*]

This invention has for its object the substitution of certain substances unacted upon by sulphuretted hydrogen, instead of the compounds of lead and copper at present in use, as pigments or paints, particularly with reference to the greens, yellows, and reds. The patentee describes his invention under different heads, as follows:—1st. In a certain process for the manufacturing, upon a large scale, of zinc yellow (chromate of zinc); barytes yellow, antimony red (sulphuret of antimony), and zinc green. 2nd. The employment of these colours for painting, in general, upon cloth, wood, walls, paper, &c. 3rd. In the mixture of these colours with others, unaffected by sulphuretted hydrogen. 4th. In mixing the oxide of zinc with other unalterable colours. 5th. The manufacture of a new dryer, in which certain peroxides act the same part as litharge in the common process. 6th. A process of polishing painting with oxide of zinc and unalterable colours, combined with the dryer above mentioned. 7. The application of the above-mentioned colours and oxide of zinc in printing and colouring paper-hangings. The patentee then proceeds to describe his processes; and, in the first place, his zinc yellows. This process is divided into three parts. By the first he obtains what he calls marigold yellow. For this purpose he mixes in a boiler 120 lb. of bichromate of potass with from 700 to 800 lb. of water, and 60 lb. of "zinc white." The boiling is continued for from 24 to 36 hours. The precipitate is then separated and washed, and the first washings added to the solution from which it was precipitated. When perfectly washed the precipitate is dried, and either reduced to powder or made up into cakes. By the second he obtains lemon yellow, by adding to the solution which remains from the first process, together with the washings which were added to it, sulphate of zinc, formed by adding to 75 lb. of oxide of zinc, 45 lb. of sulphuric acid of commerce, of specific gravity 63½°. This is to be boiled as in the first process, and the precipitate separated, washed, and dried. To the solution remaining from this last process, together with the first washings of the precipitate, he adds sulphate of zinc, formed by adding to 15 lb. of oxide of zinc 7 lb. of sulphuric acid of commerce. This is to be boiled as before, and the precipitate washed and dried. This gives a pale yellow, of a tint between the marigold and citron tint above described. The baryta yellow is formed by adding to a solution containing 100 lb. of chloride of barium, 84 lb. of the double neutral chromate of potass and soda, boiling these together, then separating, washing, and drying the precipitate. From these yellows the patentee says he can obtain any shade of yellow required by adding, if necessary, raw terra sienna, or the antimony red hereafter described. And greens in the same manner may be obtained of any shade, by adding to the yellows a blue, unacted upon by sulphuretted hydrogen. The antimony red, or orange red, is made by dissolving the native sulphuret of antimony in hydro-chloric acid, in such proportion that it will just dissolve the whole of the sulphuret; this proportion the patentee finds to be about 6 of acid to 1 of the native sulphuret. The solution is then filtered, and water or acid is added to it until its specific gravity is between 13° and 17° of the French ariometre. The patentee prefers 15°, but claims all degrees between 13° and 17°. When the solution has been brought to the above density, it is placed in a suitable vessel, and sulphuretted hydrogen passed through it. The sulphuretted hydrogen may be that evolved in forming a second solution of the native sulphuret. The tube by which the gas is conducted into the solution should be of glass, and wide enough to prevent its clogging; the vessel should be covered, and the gas made to pass through a series of vessels, and at last conducted into a vessel of milk of lime; during the process the solution should be stirred occasionally with a wooden spatula. The precipitate is to be washed thoroughly, and dried at a temperature of from 100° to 120°; at a higher temperature than this the hydrated sulphuret would lose its combined water, and become black. To form the zinc green, the patentee dissolves in hot water 49 lb. of pure dry sulphate of cobalt, and to this adds 255 lb. of oxide of zinc slaked with a little water; the whole is then boiled to dryness, and heated red-hot in a muffle. The calcined mass must then be cooled and thrown into water, thoroughly washed and dried. The patentee claims this his process of neutralising the sulphate of cobalt with oxide of zinc. The patentee next describes the process for making a dryer, or drying oil, by boiling for 6 or 8 hours 200 gallons of purified linseed oil, and then adding to this 10 lb. of peroxide of manganese in fine powder. The mixture is to be boiled for 5 or 6 hours, and filtered when cool. Peroxide of iron will answer the purpose, but it is not so effective as peroxide of manganese. If desired, the protoxide, sulphate, acetate, or carbonate of manganese may be used. This dryer may be mixed with the paint in the proportion of 1-10th to 1-20th. Instead of the dryer above described, the peroxide of manganese may be ground up with the paint in the same manner that litharge is now employed. It should, in such case, be used in the proportion of 1-10th to 1-25th. In applying his patent colours for the purpose of polished painting, the patentee lays on, first, several coats of zinc white, and when dry the surface is rubbed down with pumice till it is brought to a dead polish. The colours, whether for marbling, graining, &c., previously mixed with the dryer are then laid on, and when dry will not require varnish. In applying these colours to paper-hangings no alteration whatever is required to be made in the common process, and for the purpose of satining or watering paper, or enamelled cards, the zinc white is employed instead of the white lead now commonly used. The patentee claims:—1. The particular mode of manufacturing zinc yellow, baryta yellow, orange red (sulphuret of antimony) and zinc green. 2. The application of the above colours to painting pictures, buildings, and other objects, upon stone, wood, plaster, canvas, paper, &c. 3. The manufacture of compound colours made of zinc yellow, antimony red, baryta yellow, "zinc white." 4. Compounding the above colours with linseed or other oils, and the dryer above described. 5. The mixture of the dryer above described with unalterable colours, whether those above mentioned, or others containing neither lead nor copper, or compounds containing those colours above described, and other un-

alterable colours. 6. The application of the above-described colours to the process of painting and printing on paper-hangings. 7. The application of the above-described colours and dryer to the process of polished painting. 8. The mixture of the above colours with other unalterable colours, with or without the dryer, for the purpose of obtaining any desired shade of colour.

JAPANNING METALS.

FREDERICK WALTON, of Wolverhampton, Staffordshire, japanner and tin-plate worker, for "*an Improved mode of coating or covering, or of coating, covering, and ornamenting the surfaces of articles which are or may be made of wrought iron, or of other metal or metals; which improved mode may be used in substitution of japanning, tinning, or other modes, now in common use, of coating, covering, or of coating, covering, and ornamenting such articles.*"—Granted February 24; Enrolled Aug. 24, 1847.—[Reported in *Newton's London Journal.*]

This invention relates to coating the surfaces of wrought iron, or other malleable metal that will bear a strong red heat without injury (such as brass or copper), so as to form a glazed enamelled surface either plain or ornamented.

The first preparation is to clean the surfaces of the articles, by first subjecting them to a red heat in an annealing oven, or in a muffle, according to their size, for about half an hour, to dissipate all liquid or greasy matter, and oxidate the surfaces. The oxide is removed by rubbing with sand-stone, or scrapers. When cleaned, the articles are to receive a first coat of partially vitrifiable materials, which is poured in a semi-liquid state over the surface of the article, and distributed evenly; the article is then placed in an ordinary japanner's stove, heated to 180°, and left therein until all moisture is gradually dried away, leaving the same in a state of dry whitish composition, which will adhere to the article, without it is roughly touched with the fingers.

The composition for the first coating is prepared as follows:—6 parts, by weight, of flint-glass, broken into small fragments, 3 parts of borax, 1 part of red lead, and 1 part of oxide of tin, are to be well mixed, by pounding in an iron mortar, and "fritted" in the same manner as is usually done with the materials for making glass. 1 part, by weight, of the "fritt," so made, is to be mixed with two parts of calcined bone, ground to powder; and the mixture of fritt and bone is then to be ground with water in a "porcelain mill," until a semi-liquid, of the same consistence and appearance as thick cream, is produced, which, after being passed through sieves of fine lawn, is ready to be applied to the articles, as above mentioned.

When the first coating is dry, the articles are ready for firing, in order so far to vitrify the materials, as to harden the coating, and fasten it on the surfaces of the articles. The firing is performed in a furnace of the kind used by painters in enamel. The muffle having been brought to a full red heat, the articles are introduced, and are left therein until the earthy composition has undergone so much of the commencement of fusion, or partial semi-vitrification, as to render the earthy particles of the coating firmly adherent to one another, and to the surface of the articles, which are then to be withdrawn from the muffle, and laid on a flat iron bench to cool; when cold, those parts of the surface which have been coated, present a dead whitish appearance, resembling earthenware in the state of "biscuit:" the time that the articles must remain in the muffle, varies from a few minutes to half an hour, according to the heat of the muffle, the size of the articles, and the number of articles in the muffle at the same time. After the articles have become cool, the coating is wetted with water, and a second coat is then applied over the first coat, and dried thereon in the japanner's stove; it is then fired in the muffle in the same manner as the first coat. The composition for the second coat is prepared as follows:—A thick paste is made, by mixing 32 parts, by weight, of calcined bone, ground to fine powder, 16 parts of china-clay, 14 parts of Cornwall stone, in fine powder, and 8 parts of carbonate of potash, the latter being dissolved in water; the mixture is fritted for two or three hours in a reverberatory furnace, until it assumes the appearance of biscuit-china; and then it is to be reduced to powder. 5½ parts, by weight, of this powder, are mixed with 16 parts of flint-glass, broken small, 5½ parts of ground calcined bone, and 3 parts of ground calcined flint; and the mixture is reduced to the consistence of cream, by grinding in a porcelain mill, in the manner described for the first composition. In firing the second coating, care must be taken that the heat of the muffle is sufficient, and that the articles are kept in long enough to effect the thorough incorporation of the second coat with the first, and to harden both coats. After the second coating, the articles will have a stronger and whiter colour, and bear a more decided resemblance to articles of good earthenware in a state of biscuit; but in case it is desired to give a very white colour to the second coating, in order that it may resemble the finest earthenware in the state of biscuit, then, in place of the 16 parts of flint-glass, last mentioned, the patentee substitutes a like quantity of a composition, formed by mixing 4 parts, by weight, of pulverized felspar, 4 parts of white sand, 4 parts of carbonate of potash, 1 part of arsenic, 6 parts of borax, 1 part of oxide of tin, 1 part of nitre, and 1 part of whiting, fritting the mixture, and then reducing it to powder.

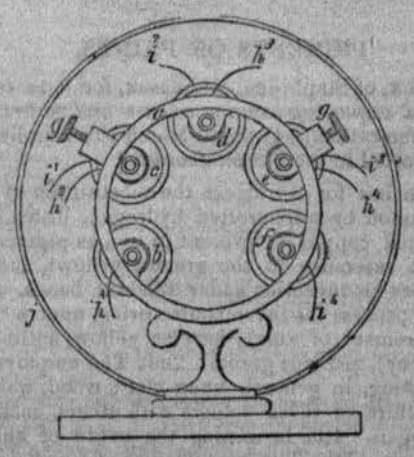
When the articles have become cool, after receiving the second coat, this coat is wetted with water, and a third coat is applied, and fired in a similar manner; and, when cool, the article will present the appearance of glazed earthenware of good quality, or of the best quality, in case the composition, last mentioned, has been substituted for the flint-glass amongst the materials for the second coat. The materials used for forming the third coat or glaze are, 12 parts, by weight, of pulverized felspar, 4½ parts of china-clay, 18 parts of borax, 3 parts of nitre, 1½ parts of carbonate of potash, and 1½ parts of oxide of tin: these ingredients are treated in the same manner as those for making the second coat. Instead of the materials and proportions just mentioned, the following may be used:—9 parts, by weight, of pulverized felspar, 2 parts of china-clay, 9 parts of borax, 2 parts of nitre, 3 parts of carbonate of soda, and ¼ part of arsenic. In case there are any imperfections in the glaze, after it has been fired, then, when the articles are cold, another coat of the glaze may be applied, in a semi-liquid state, and dried in the japanner's stove, and fired in the muffle in the same manner as the first glaze: in like manner, a third coating of the glaze may be applied, if requisite.

The articles that have been coated on one side, may have the opposite side coated with black glaze, applied with a sponge when in a semi-liquid state, dried on in the japanner's stove, and then fired in the muffle. The black glaze may be composed of the same materials as either of the compositions, before described, for the third coat or glaze, with the addition of 2 parts, by weight, of oxide of manganese, and 1 part of cobalt; which materials are to be added to the other ingredients, previous to the mixture being fritted. If a deep blue glaze is preferred to black, then the oxide of manganese may be diminished or omitted; and so much as is omitted may be replaced, weight for weight, by cobalt, in addition to the quantity of cobalt above mentioned. Or, instead of the back or under side of the article being coated with black or blue glaze, it may be finished by japanning, according to the method usually adopted by japanners.

ELECTRIC LIGHT.

THOMAS WRIGHT, of Cooper's-hill, Thames Ditton, Surrey, Esq., for "*Improvements in apparatus for the production and diffusion of light.*"—Granted March 9; Enrolled Sept. 9, 1845.

This invention consists in producing a permanent light, by presenting one or more fresh points or surfaces of carbon, or other suitable material, continually to the path of an electric current, by an apparatus similar to the annexed engraving. *a*, is a double annular frame



of wood, or other non-conductor of electricity, with five (or more) discs *b*, *c*, *d*, *e*, *f*, turning on axes with bearings attached to the frame *a*. The discs consist of two circular plates of brass, or other metal, with a disc of plumbago or carbon (the latter being preferred), between them, somewhat larger in diameter than the brass plates, about one-fourth of an inch thick, and having an angular or V-shaped edge. The axes of two of the discs *e*, *e*, are mounted in sliding

carriages, and can be moved backwards and forwards by the screws *g*, *g*. The discs are made to rotate slowly by means of an endless band, with pulleys and wheelwork, actuated by a weight or other prime mover; a current of electricity being then passed through the series of discs, a brilliant light will be produced at those edges of the discs that are adjacent to each other. A current of electricity may be caused to pass through the discs, by connecting one wire of a galvanic battery with the axis of the disc *b*, and the other wire with the axis of the disc *f*; but, in order to economize the power, the patentee prefers to separate the battery into four parts, and transmit a separate and distinct current to each pair of discs, by means of the wires h^1, h^2, h^3, h^4, and i^1, i^2, i^3, i^4. In order to produce the desired effect, the discs *c*, *e*, are to be brought into contact with the discs *b*, *d*, *f*, by turning the screws *g*, *g*; and as soon as the electric current is established, and the points of contact sufficiently ignited, the discs *c*, *e*, are to be moved out of contact with the other discs, when a brilliant and permanent light will continue to be evolved at the adjacent parts of the discs, so long as the discs are kept rotating, and the electric current continues to pass. In order that the electric light may be uniformly diffused, the apparatus is enclosed in a ground glass globe *j*.

SLUB CHAINS.

WILLIAM BAYLIS, of Bilston, Stafford, chain-maker, for "*a machine for flattening and turning iron links for flat-wood slub-chains.*"—Granted February 20; Enrolled August 20, 1847.

In forming the links of flat-wood or slub-chains the sides are flattened while the ends at the connexion of the adjoining links are cylindrical. Such formation has hitherto been accomplished by hand forging. In order to the well working of such chains, it is necessary that considerable uniformity should exist between the separate links, which require much skill and consequent expense in their manufacture.

Now the object of the present invention is to produce the required flattening to parts of lengths of iron, and partial bending of the same by mechanical means, so as to facilitate the formation of the links, and lessen the cost of the manufacture.

The annexed engravings show a machine for making the links. Fig. 1, is a side view; fig. 2, a plan; and fig. 3, an end view. *a*, the framing of the machine; *b*, the driving axis, to which motion is

Fig. 1. Fig. 3.

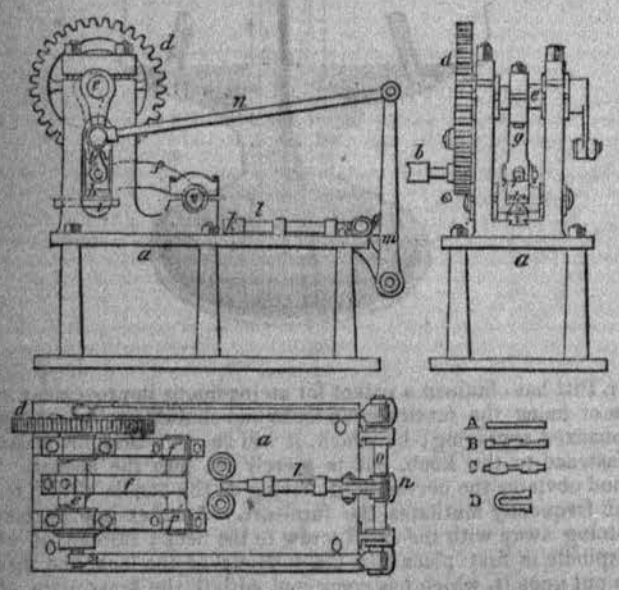


Fig. 2.

given by a steam engine or other power; on the axis *b*, is a pinion *c*, which takes into and drives the cog-wheel *d*, on the crank axis, *e*, and gives motion to the arm *f*, by the link *g*, and carrying the upper face plate *h*. *i*, is the lower face plate, upon which a length of iron A, for the intended link and heated to a moderate heat, is to be held so as that by the descent of the arm *f*, a flattened part, as shown at B, is produced, and then the length of metal A, is to be put end to end, so as to produce another flattened part B, as shown at B, C. The lengths thus formed are then to be placed against the rollers *k*, when by the coming forward of the forcer, *l*, they will be bent into the shape shown at D. Motion is given to the forcer, *l*, in the following manner: *m*, *m*, are arms which at the upper ends are connected to the connecting-rods, *n*, *n*, which receive a to and fro motion from the shaft; the lower ends of the arms, *m*, *m*, are affixed to the shaft, to which is also affixed the arm, *p*, which by means of a link gives motion to the forcer, *l*. The links produced, as shown at D, are afterwards to be welded together in the ordinary way.

STEAM ENGINE IMPROVEMENTS.

WILLIAM KNOWELDEN, of Great Guildford-street, Southwark, engineer, for "*improvements in steam engines.*"—Granted December 31, 1846; Enrolled June 30, 1847.

This invention relates to obtaining two revolutions of a shaft of a reciprocating steam-engine for each complete stroke of the piston.

Figs. 1 and 2, are an elevation and a plan of a reciprocating steam-

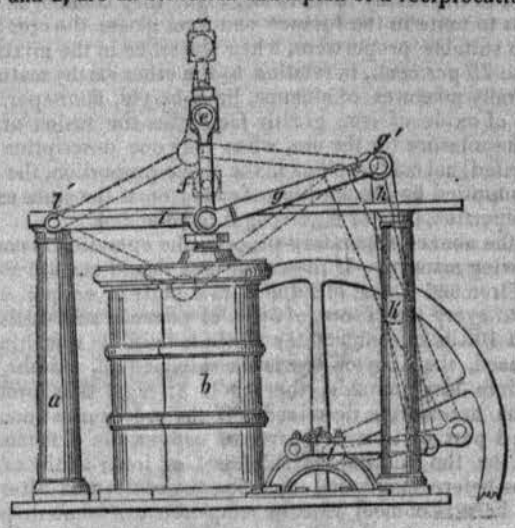


Fig. 1.

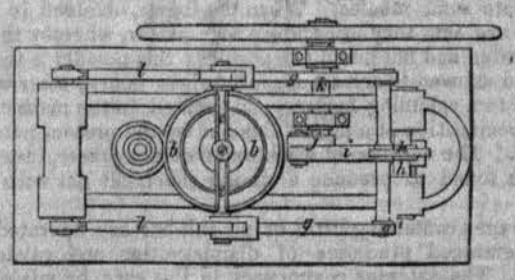


Fig. 2.

engine, showing the improvements. *a*, *a*, is the framing. *b*, the steam cylinder. *c*, the piston rod. *e*, the cross head; and *f*, the side connecting rods which are at one end in connexion with the cross head *e*, and at the other end in connexion with the connecting rod *g*, which is forked so as partly to embrace the cylinder and to allow of its being in connexion with both of the rods *f*, and this connecting rod is at the end, *g'*, in connexion with the beam or lever *g*, moving on an axis in the centre, by which the end, *g'*, of the lever, *g*, is controlled to move to and fro in nearly a straight line, which is one peculiarity of the invention, and such beam or lever at one end moves on an axis at *g'*, its other end by a connecting rod, *i*, gives motion to the crank, *j*, on the main shaft *k*, of the engine; thus will the crank shaft be caused to make a complete revolution each time the piston moves from end to end of the cylinder, and therefore two revolutions for each complete stroke of the piston. *l*, *l*, are two arms from the axis, *l'*, one on each side of the cylinder, in order that they may be in connexion with the two side connecting rods, *f*. These arms are for the purpose of controlling the working of the parts, and to ensure the end *g'*, of the connecting rod *g*, making a uniform to and fro movement each time the piston passes from one end to the other of the cylinder; but it is obvious that the same result would be obtained if the ends of the rods, *f*, *g*, were controlled by guides to move in the same direction.

The claim is for combining the parts *f*, *g*, *i*, with a crank shaft or axis so as to obtain two revolutions of such shaft or axis for each complete stroke of a reciprocating steam-engine.

SMELTING COPPER.

JAMES NAPIER, of Shacklewell-lane, Middlesex, operative chemist, for "*Improvements in smelting copper or other ores.*"—Granted March 2; Enrolled September 2, 1847.—[Reported in *Newton's London Journal.*]

This invention consists in improvements in smelting copper ores, by treating them with fluxes, consisting of common salt, lime, and carbonaceous matters; and also in improvements in smelting ores, containing silver, or gold, or both those metals, by the addition of alkaline substances, coal, iron, and galena.

The first object is to facilitate the separation of the earth from the copper; and to effect this, when several ores of different descriptions are to be operated upon, the patentee mixes them in such proportions, in relation to the earthy matters or gangue they contain, as will cause the earths to unite in the furnace and form glass: the ores have been mixed in suitable proportions, when the silica in the mixture ranges from 50 to 75 per cent., in relation to the other earthy matters, which are generally mixtures of alumina, lime, baryta, fluor-spar, &c.,—the presence of oxide of iron greatly facilitates the fusion of the ores. Should the mixture (or the ore, when only one description of ore is being treated) not contain silica in the above proportion, the deficiency is to be supplied by the addition of sand; or, if the silica exceeds the above proportion, lime or fluor-spar is to be added.

After the above preparatory process, the operation is conducted in the following manner:—If the ore or ores should contain not less than 1 part of iron and 1 part of sulphur, to 2 parts of copper, an addition is made to every ton of ore, of 56 lb. of common salt, 40 lb. of slaked lime, and 100 lb. of coal, and the whole is fused in a melting furnace. When fused, the slag or scoria is skimmed off, and the furnace is tapped into sand moulds: the ingots or pigs, thus produced, are treated as hereinafter described. If the ore or ores should contain less than 1 part of iron to 2 parts of copper, the deficiency is to be supplied by the addition of sulphuret of iron; or the ore is to be treated as before mentioned (omitting the coal); and after the fused mass has been skimmed, 30 lb. of scrap-iron are to be dispersed over the surface thereof, as equally as possible, and the door of the furnace is closed until the scrap-iron is melted; the furnace is then to be tapped into sand moulds. When the ingots, obtained in the above manner, are set, they are thrown into water, whereby they become disintegrated and fall into a fine powder; this powder is thrown into a heap, and allowed to remain for forty-eight hours; after which, it is removed to a calcining furnace, and treated in the manner described in the specification of a patent obtained by the present patentee, July 20, 1846. The addition of black oxide of manganese, instead of iron, has been found to produce a similar effect, but not with equal advantage.

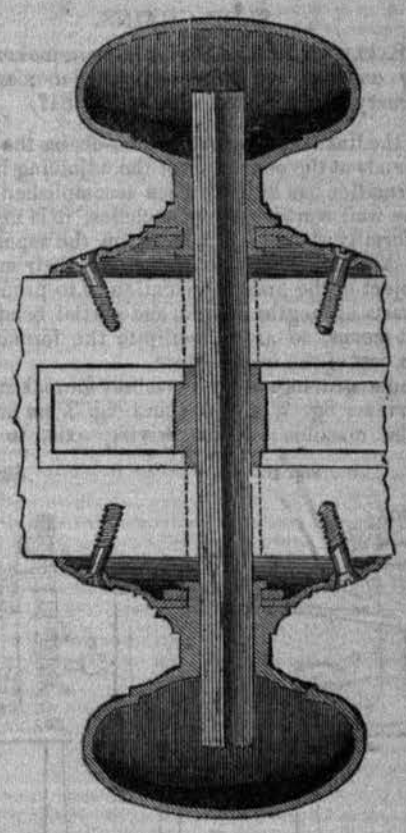
When ores containing little or no sulphur are operated upon, the above-mentioned processes of disintegration and calcination are omitted. The patentee commences, in this case, by mixing the ores, in relation to their earthy matters, so as to form glass, as above described (the ores, when containing no iron, might with advantage have a small quantity of oxide or carbonate of iron added); and then 80 lb. common salt, 50 lb. slaked lime, and 100 lb. anthracite coal, finely pulverized, are added to each ton of ore containing 10 per cent. of copper. If the ore should be richer in copper, a smaller proportion of salt and lime will suffice, and a greater proportion of anthracite of coal will be required: the patentee says, he has found, that for an ore containing 25 per cent. of copper, 56 lb. common salt, 50 lb. slaked lime, and 150 lb. anthracite coal will answer well. The mixture of ore and other materials is fused in a melting furnace, which, for a charge of 25 cwt. of ore, will take from five to six hours; and then the fused mass is tapped into sand moulds: the copper, thus obtained, will generally be ready for the refining operation; but should a portion of the produce be regulus, it is to be roasted, and afterwards refined. Soda and several of its salts may be used instead of common salts; and so likewise may potash and several of its salts, or mixtures of these, free from sulphur.

Sulphuretted ores of copper, containing silver, or gold, or both these metals, are treated in the following manner:—The ore is first calcined and fused, as in the ordinary smelting process, so as to produce a regulus, containing about 50 per cent. of copper; with every ton of this regulus, 56 lb. soda-ash, 40 lb. slaked lime, 1 cwt. coal, 1½ cwt. iron in scraps, and 4 cwt. galena (sulphuret of lead) are mixed, and the mixture is fused in a fusing furnace until the iron disappears; the fused mass is then well rabbled and tapped into sand moulds. The lead will be found reduced at the bottom of the first and second ingots, and will contain all, or the greater part, of the silver, or gold, or both, which the ore previously contained; these metals are afterwards separated from the lead by the ordinary methods of separating silver and gold from lead. The copper is treated in the ordinary manner, or as described in the specification of the patent before alluded to. Instead of galena, the oxide of lead may be employed; in which case the iron is dispensed with; but the patentee prefers to use galena.

When treating ores of silver, or gold, or both, which do not contain copper, or which do not contain it in the state of a sulphuret, the patentee adds copper pyrites thereto, in the proportion of 4 cwt. of the latter to 16 cwt. of ore, and then proceeds in the manner above described, viz., bringing the material into a state of regulus, and fusing it with soda-ash, lime, coal, iron, and galena.

In conclusion, the patentee says, that he does not confine himself to the precise details, or proportions of the ingredients used, so long as the peculiar character of the invention be retained.

LOCK FURNITURE AND SPINDLES.



Mr. Pitt has obtained a patent for an ingenious improvement in the mode of fixing the furniture on locks and shutter knobs, as shown in the annexed engraving; by which, it will be seen that the spindle is not fastened to the knob, but is merely let into the socket. This method obviates the necessity of driving on the handle with a mallet, which frequently mutilates the furniture. Another improvement is the doing away with the small screw in the neck; instead of which, the spindle is first placed in the follower of the lock, and then the knob put upon it, which has connected with it the brass plate of the rose; this plate is firmly fixed to the door by small screws, over which there is a cover rose furnished with a collar with a female screw, and which is fastened by two or three turns on to a screw round the neck of the brass plate: thus the screws and brass plate are completely concealed. The improved furniture is manufactured by Messrs. Hart and Sons, ironmongers, of Wych-street, Strand, and may be had either in glass, china, ebony, ivory, or other fancy fittings.

KING'S COLLEGE, LONDON.

Introductory Address; read to the Students in the Department of the Applied Sciences, at the commencement of the Session, on Tuesday, October 5th, 1847, by D. T. ANSTED, Esq., M.A. F.R.S., Professor of Geology to the College, and Dean of the Department.

GENTLEMEN—Occupying, as I have the honour to do, the office of Dean of the department of the Applied Sciences for the ensuing year, I have thought it expedient, following the example of another department of our College, to open the business of the academical year by an address, in which I shall endeavour to explain to you briefly some of the objects, peculiarities, and benefits of the education which is here offered, and of which, it is to be hoped, you will take every advantage.

The object of this department of the Applied Sciences is to give *general* education, as distinguished from *professional* education We wish to give this general education, however, in such a manner and to such an extent, that special education in engineering, architecture, and some other very important professional pursuits, may rise naturally from it and be intimately connected with it. It has been endeavoured so to arrange the course, that the required practical knowledge and manual dexterity for such pursuits shall be connected with and arise from the sound educational principles inculcated in the lecture-room.

Education is, in one very important sense, the serious occupation of every thinking and acting man. It commences with our entrance into the world; it is carried on, whether for good or evil results, with great energy and incessantly, through early childhood and youth; it is continued, also, whether we will or not, as we advance into manhood; and so long as we remain on this side the grave, so long do we continue to learn,—to acquire new habits, new thoughts, new ideas, and to exercise some influence over our fellow-men. It is only the idiot who can escape—although it is the privilege of the idle and the inactive to approach in the nearest degree to this lowest condition of our human nature.

But although education—or the training of the human intellect to accomplish the purposes of man's nature—is thus a process constantly going on, there is a particular period of life when the faculties are in their early vigour and the physical powers as yet unworn by the pressure of mental excitement; when the memory is fresh and not burdened with the experiences of a life; when the light amusements of childhood pall upon the senses, and thought begins to take the place of simple, unthinking observation;—there is this period in the life of every one, in which it is possible to sketch in simple outline some truthful delineation of the future, and when, therefore, it becomes of the most earnest importance that the sketch should correspond with the intellectual and mental peculiarities of the individual. This is the time when school gives place to college; when mere routine, imposed from without, is to a certain extent changed to voluntary, and in many cases more severe, mental exercise; when new, powerful, and lasting impressions are made; when new associations are formed, which will probably long influence the habits and the character; and when, in a word, what there is of intellectual and moral in the character begins to expand, becomes less dependent on circumstances, and takes some special direction which is rarely afterwards changed.

In the great majority of cases, the part in active life that is to be taken by every individual is determined for him by external circumstances, over which he has little control. In such instances, it is however not unusual that, in addition to and beside the direct occupation or business of an educated and intelligent man, there is some one subject or department of knowledge pursued quietly and as an amusement, to the infinite advantage of himself and his family, and by no means to the detriment of his business. In other and rarer cases, the occupation is at the same time the amusement. Both of these cases may be greatly affected by the education of the youth, as he is passing into manhood. Both therefore should enter into every scheme of education; for, however we may conclude from philosophical speculation, no one accustomed to observe will doubt that there are certain tendencies that are peculiar to the individual; and that as no one man so accurately resembles another, that we cannot determine some point of difference, so no one intellect is without its individuality—capable of being directed more easily in one path than in any other.

Thus, as there are different objects to be attained, and human intellects differently constituted to attain them; as society requires all powers to be developed, and needs the exertions of all her members, it is only just and reasonable that in that transition state of which I have reminded you, and in which you are, there should be various ways of arriving at the required result—namely, the providing men adapted to carry out fully the objects of society in all departments. The attainment of the public good in this sense is, I conceive, the practical fulfilment which a nation is required to attempt of the sacred maxim—"to love our neighbours as ourselves." It is acting with a view to benefit mankind at the same time and to the same degree that we are ourselves personally and intellectually benefitted. The establishment of places of education, such as this College, and of this College especially, has resulted from the endeavour to carry out this purpose; and you who are about to profit by the course of instruction here afforded, are bound to recognise with gratitude the opportunity which is thus offered you; and placing yourselves, or being placed, under such obligation, you will be responsible, each to his own conscience, for the result.

The kind of education offered in that department of the College to which you are attached is peculiar, and scarcely resembles any system previously adopted. It has already proved most successful, as an attempt to extend the advantages of college education to many whose special object in after life was likely to be more distinctly *active*, than either contemplative or dependent on the constant and exclusive exercise of the intellectual powers. Some modification seemed needed of the ancient and not unuseful system adopted in our universities of Oxford and Cambridge, for the time required and there employed in the cultivation of language and pure mathematics, had, during the lapse of years, gradually stolen on from the period of boyhood to that of manhood; and for this reason, those whose pursuits would remove them entirely from the further prosecution or application of such subjects, were necessarily deprived of the advantages of college discipline. They were also without the opportunity of acquiring, by any good system, the groundwork and elementary knowledge which should be really useful in their subsequent employments.

The endeavour to determine whether in our own country, as on the continent, it might not be possible to establish a system not less sound and based no less on the peculiar nature and requirements of the human intellect in a certain stage of its development, than that system which has produced so many and such great divines, lawyers, and natural philosophers,—whether, I say, it might not be possible to modify that system, so as to produce men no less useful and no less distinguished in the paths of active and business life—whether we could not by such modification bring forth energies hitherto dormant, and induce a more systematic and philosophic application of thought and intellect to every-day life and ordinary business,—rendering men better able to apply science, because they had been taught to know it properly;—this, I repeat, was the object of the experiment that has been first tried in this place.

It is my intention in this introductory address to explain to you something of the nature of the system we have adopted, and the spirit in which it should on your part be received. You are those on whom we depend for success—we must be supported by your exertions; and we are bound, therefore, to tell you what are our real views and feelings with reference to the working of our plan.

Now, one of the first things that it is necessary to observe may seem, perhaps, somewhat paradoxical: we wish rather to educate than to communicate knowledge. Knowledge in itself is no doubt good; but, in our opinion, education is better, and of far greater importance to you. Our whole system—the College system in the best sense—is a course of training adapting the intellect to acquire knowledge, but only teaching knowledge incidentally. This, it must be understood, is not merely a theory, but a pervading principle. It is not seen in the individual lectures, but it is felt in the general conduct of the whole.

The course of study in the department extends over a period of three years, and in each year the subject of *Mathematics* is expected to occupy a considerable portion of the time and thoughts of the student, the time however diminishing a little as he advances.

The experience of many years and many lives has shown, that for the purposes of mental discipline the peculiar habits of thought and accuracy of expression demanded in the pursuit of mathematical science are in the highest degree valuable. For this reason, as well as because mathematical knowledge is absolutely required in the practical applications of science, you are conducted step by step through that perfect chain of reasoning which has been handed down for more than twenty centuries as the foundation of geometry; you are taught the nature and meaning of that symbolical language, by which, in the hands of a master, the most difficult and obscure problems are ingeniously solved; and you are further made acquainted with the principles as well as the methods according to which this symbolical language of *algebra* may be applied to the determination of problems in geometry, the thinking out of which by continuous argument would be exceedingly difficult, and in some cases perhaps almost impossible.

I allude thus briefly to the fundamental principles of pure mathematics, which form an essential portion of your early studies in this place, in proof of what I have already stated concerning the nature of the education offered. It is based on no hypothetical or speculative novelty, but commences, as all useful education must do, by training carefully the reasoning faculties; and it selects for this training the subject of pure mathematics, as that most likely to be afterwards useful. Be assured that the time and labour bestowed on this part of your studies will never be regretted in after-life, and that whatever your pursuits may be, this mental training will help you to succeed in them.

In thus speaking of the principles of geometry as taught by Euclid, and the nature of algebra as introducing a knowledge of symbols, I have said all that is necessary to illustrate the views adopted in this department of the nature and use of mathematics in education; but I cannot leave the subject without reminding you, that however important it is to understand fully and clearly the bearings of any subject that concerns us deeply, nothing in the whole of education is so important as the having a distinct and clear appreciation of the nature of the argument in every demonstration in geometry, and the meaning of the symbolical expression in every elementary proposition in algebra. Your progress by help of memory is of absolutely no value without this; for nothing is less useful or less important than the mere learning by heart the propositions of Euclid, or performing, without understanding them, the ingenious transformations by which problems are sometimes solved.

While the study of pure mathematics is thus insisted on as the first element in your education—and in this respect the course of instruction is

simply a transcript of that which has been found useful at one of our older universities—there is also introduced at the same time another subject, differing much less in reality than in appearance, and of scarcely inferior value as a means of education. I allude to that elementary view of *Chemistry* which is presented in your first year. For if the pursuit of mathematical investigation is valuable in its lasting influence on the conduct of the intellect and the reflective faculties, the elements of chemical philosophy form a subject equally well adapted to improve the faculty of observation and the nature and use of experiment as a means of acquiring knowledge. The one science teaches us to reason upon assumed data; the other to interrogate nature from observed phenomena. The mathematician commences by assuming and defining, the chemist by observing and experimenting: the former is independent of nature and external phenomena, the latter deals only with that which is—with matter in its various forms, and the laws according to which those forms are modified and mutually related.

The introduction of chemistry as a subject of elementary instruction is one of the peculiarities of the course of study here adopted. It is a distinct and marked recognition of the value of experimental science; not merely for its direct result in a certain amount of useful knowledge acquired, but in its effect on mental culture. And in this respect I would have you consider it and avail yourselves of it.

Chemistry is the link by which pure mathematical science is connected with natural history. To understand clearly in what way and to what extent the result of that abstract cultivation of the reflective faculties—requiring theoretical certainty in every proof—differs from the habit of arriving at results by the comparison of various observations and the weighing of probabilities, would involve a disquisition much longer and more metaphysical than I am at present inclined to offer: but I am sure that no one, who is aware of these two very different ways of convincing the human mind, will deny the value or the practical necessity of the latter method in the great majority of cases that present themselves for determination. For this reason it is that the evidence of experimental observation, as taught in the first and simplest operations of chemistry, is of extreme value; and for this reason chiefly—whatever may be your occupation subsequently—you will always feel the benefit of having been taught the principles of chemical science.

And what is perhaps the most beautiful and most interesting point in such education, is that we learn these important habits of mental discipline without effort, and almost without being aware of it. No one whose intellects are fresh and healthy, can enter on the pursuit of natural science, especially in this its most attractive form, without being charmed by the simplicity and beauty of the results obtained by the chemist—exhibited as they are in experiments that command attention by their novelty, no less than by their manifest usefulness. The method of experiment is the first method of nature,—the child and the boy pursue it unthinkingly, and the philosopher differs from them only in arranging and directing his inquiries with reference to some definite and important object. Most of our ideas, if not all of them, are introduced by those inlets to knowledge which we call the senses; and the infant, stretching forth his tiny hands to touch that object which is beyond his reach, and which is only recognised by the eye, is a type, and no unworthy type, of the great master of chemical science, exerting his powerful and well-trained intellect to bring within the range of comparison various results of observations variously made, and to connect phenomena apparently distinct by discovering the nature of their difference and the laws by which they are alike governed.

While the study of mathematics thus tends to cultivate the reasoning powers, and teach the nature of *abstract* truth; and the pursuit of chemistry quickens the observing faculties, and proves the value of *experimental* truth,—there is one department of natural history to which your attention is also required during the first year of your academic studies. It is *Mineralogy*; and by it you will learn something of the methods of recognising important and characteristic peculiarities in which various natural objects differ from or resemble each other. You thus learn to discriminate and to compare; and you learn also why certain characters are more important than others, and how best to seize the true distinctive marks. Nor is this introduction to the classificatory sciences itself unimportant as a mental exercise; but, on the contrary, you will do well to pay careful attention to the reasonings here presented to you, and to the conclusions deduced. As bearing upon chemistry, and teaching the nature and value of the combinations of matter presented in the structure of the earth's crust, mineralogy also presents a large and interesting group of facts, many of which have still to be referred to their legitimate places in science; and many such facts, which at first seem isolated, will be found to have a bearing on questions afterwards presented, concerning the mode in which nature works in her vast subterranean laboratory. Mineralogy is also intimately related to the subject of Geology, to which in the second year of your studies your attention is also directed.

The remaining subjects of study for the first year involve some departments of natural philosophy not requiring mathematical knowledge; some of the elementary practice of surveying; instruction in drawing—useful to all, and absolutely necessary for every practical man; and familiar knowledge of simple machines, and the use of tools in the workshop; since without practical knowledge no one is qualified to superintend the work of others with regard to such subjects.

I can hardly dwell too strongly or allude too often to the practical value of instruction like this. To appreciate the *ideas* of force and motion by reference to actual examples,—to learn the nature and calculate the effect of *laws* of force and motion by the rule and compass,—by the scale and the measure:—to see exemplified to the senses the reality of those effects which by abstract calculation ought to be produced—these are views of natural philosophy which amuse whilst they instruct, and which are easily remembered and constantly put in execution. This system of combining example with precept is well adapted to carry out the objects of the course of education adopted, for it necessarily suggests a ready means of applying experiment to theory; and thus shows at once the value of mathematical calculation, and its most direct and available use.

Nor is it less interesting or less useful to the active spirit of the young student, that he should be shown and hear explained some of those more complicated contrivances which form the boast of our age and have so largely contributed to the greatness of our country. To be able to examine not merely machinery and models, but machines and factories,—to be taught the principles of their construction whilst they are seen in full activity and performing their appointed task,—to watch the results when not the success of a lecture-room experiment, but the fortunes of many and the lives of thousands are dependent—this kind of instruction cannot fail to be as permanently valuable as it is deeply interesting.

But, as I have already reminded you, general instruction in machinery is here accompanied by a special and manual instruction in the workshop. The use of tools, the dexterity required in overcoming mechanical difficulties, and the habit of regarding detail, thus introduced, must be of the greatest value to every man, whatever his position in life may be. And this kind of education, it should be remembered, is not less valuable to the country gentleman, whose object it is to improve his own property or advance the interests of his fellow creatures, than to the engineer, the architect, or the surveyor. The ingenuity which has recently been brought to bear on the manufacture of an astronomical instrument, perhaps the most remarkable that the world has ever seen, is a striking, but by no means a solitary, example of the value of this mechanical knowledge to all. The Marquis of Worcester two centuries ago, and Lord Stanhope in more recent times, are singular instances of men, who, from their position in society, might seem removed from such employment, but whose manual dexterity in the workshop was not less remarkable than the inventive genius they exhibited in machinery. The workshop will not, therefore, be neglected by any one who wishes to occupy a distinguished or even a respectable position in his profession as an engineer or an architect.

It is equally impossible for any one to succeed in such occupations without a familiar knowledge of the principles of geometrical drawing and surveying. Both are required; and both, as they need much practice, must be commenced early and continued steadily. As you advance, and exhibit a taste for one or other particular subject, it may be advisable to turn this instruction in some special direction: but for the first year, the acquiring a useful habit is perhaps of more importance than the extent to which advance is made.

During the second year, the nature of the instruction communicated and the methods adopted do not vary greatly from the scheme I have already explained, the extent of the instruction and the introduction of new and more advanced portions of the various subjects making the chief difference. But there are two points in the education of this year to which I wish to direct your more especial attention. They are the course of lectures on practical chemistry, and that on physical geography and descriptive geology.

The instruction in mathematics, which for the first year was confined to those departments which chiefly involve principles, now includes some of the higher branches, and involves an investigation of the methods according to which pure mathematical science is applied to solve important and complicated physical problems. The instruction in natural philosophy corresponds with and assumes this advance, and involves a consideration of some of those important theories on which depend the working out of practical mechanical problems.

But in chemistry a new view of the subject is taken. From chemical principles you advance to chemical practice, and to the nature of those changes produced in various ways on the raw materials employed in the arts, and dependent on the action of what are called chemical forces either directly or indirectly.

In this way you are introduced to the same kind of information connected with the laboratory and the principles of chemistry, as you have in the lectures on machinery and manufacturing art; which may indeed be considered as the practical and best illustrations of natural philosophy, as the others are of chemistry. When you look around and consider the infinite value of a knowledge of chemical science in the vast multitude of delicate and important operations carried on in our manufactories, you will recognise the value of this part of the course. In all those employments in which *colour* is introduced or required, not only in dyeing but in bleaching, as well as in the arts of tanning and soap making, in the manufacture of salts and acids of various kinds—a knowledge of practical chemistry is the foundation of the whole knowledge needed. In brewing also and distilling—in metallurgy in all its departments, and of late years in many extremely important operations connected with the mixtures and alloys of metals, the same dependence on chemistry obliges every one whose business connects him in any way with them, to study the theory and the practical applications of this science. It is not without reason then that I urge the advantage of this part of your education of the second year. It involves chiefly, as you will perceive, the accumulating a vast number of important facts, and thus to a certain extent differs in character from the education previously afforded.

In the progress with regard to natural philosophy and chemistry will be

recognised at once the nature of the education at this part of the course. You will also perceive that the education, although eminently practical, is at the same time founded on principles previously inculcated, and that its result is by no means to form premature engineers or professional men of any kind, but is hitherto confined to creating a class of well-instructed persons, fit for any practical employment whatever.

Together with the applications of chemistry, the subject of geology is now introduced, as a science to which the attention of the students of the second year is especially directed; and as this is the subject on which I shall myself have to address you, I will only at present dwell upon it so far as to give a sufficient idea of its relative importance amongst your studies, and the place which in my opinion it ought to occupy.

The pursuit of geology may be considered to involve three distinct subjects—a mere description of the earth's crust, and an account of the order of arrangement of the materials regarded simply as matter of fact—a history of the earth as deduced from such observed fact, and applied to account for the appearances—and a statement of the practical results of knowledge of this kind with reference to the practice of engineering and mining, agriculture and architecture. Following in some measure the plan adopted in chemistry, I at first introduce to your notice the principles of geology, and describe the facts observed. I afterwards explain the direct practical applications, and the mode in which these are best made. The former is the subject of a course of lectures given to the students of the second year—the latter is now confined to the third year.

Geology is essentially a science of observation; but as all facts must be grouped and laws obtained from them before they are practically available, a knowledge of the history of the earth, as deduced from the observation of phenomena, is necessary before the facts themselves can be applied. This history I endeavour to give, avoiding as far as possible mere theory, but always having reference to general principles; and, as a department of natural history, possessing all the advantages that belong to the details of that science, and at the same time offering a yet wider and more important field of philosophical speculation, I believe no subject is better adapted for educational purposes, or more likely to enlarge the mind and strengthen the expanding intellect. The vastness of the operations considered; the extreme duration of time involved; the singular variety and the mysterious succession of organic beings; the evidence of the action of chemical forces on a scale so grand that the mind can with difficulty grasp and appreciate it,—all this tends to give to the subject a hold on the imagination; and has in some cases given alarm, and in others extravagant wildness, to the well meaning, but not well informed pursuer. A calm and dispassionate view of the facts, and reasonable deductions from them, forms however, as I have said, a subject not ill adapted to instruct and improve the student, and is absolutely necessary for a fair appreciation and efficient use of the science of geology, as applied to engineering and mining operations.

It is considered important that the student, who has thus carefully acquired during two years habits of thought and observation, who has become acquainted with elementary principles, and is to a certain extent familiar with methods, should terminate his educational course by a third year spent in the acquirement of the higher branches of knowledge, and in the obtaining practical information on various subjects connected with engineering and architecture. The higher mathematics, and more especially the geometry of solids; the principles of mechanism; the modes by which strength of material is tested, and the force of complicated machines estimated; the arts of construction as exemplified in extensive and important public works; the details by which the engineer is enabled to superintend and estimate the cost of such works,—all these enter into the course which is thus provided, and they must necessarily be excluded from the instruction given to the less advanced student. In addition to this, however, the art of chemical manipulation, in which each student is himself engaged in practical analysis and research, and in which he has the advantage of the laboratory and the superintendence, in this case personal and direct, of the professor, cannot fail to be of the greatest value even to those who will hardly again be called upon to investigate personally in this branch of science. With a view to assist in carrying out most fully the high practical character of the education afforded, I have myself undertaken to deliver to these advanced students a special course of lectures on the most important practical applications of geology and mining. We thus hope that at some time the attention of those interested in the progress of education, and who have the ability as well as the inclination to do good, may learn the advantage of inculcating science as a necessary adjunct to practical knowledge; instead of leaving practical men who would willingly receive a sound education, scarcely any means to obtain even technical knowledge, except by incurring great expense and serious loss of time.

In thus speaking of the various branches of instruction afforded to the students of each year, I have not hitherto alluded to that religious instruction which forms a characteristic feature of this as of every other department of our college education. The lectures of the Principal and the Chaplain on some of the more important subjects of divinity, are not only in themselves essential, as keeping up that association of religion which is so valuable, but must also be regarded as a portion of the scheme of education.

The object of all our efforts here is, as I have already reminded you, essentially collegiate: it is to form the christian and the gentleman—the useful member of society as well as the efficient and intelligent engineer and man of business. The discipline of this place and the good feeling for which it has ever been remarkable, is the earliest fruit and most gratifying foretaste of ultimate success. It is a proof of well-regulated intellect as well as good feeling when the natural liveliness and exuberant spirits of youth are confined within decent bounds, and do not feel trammelled by wholesome regulations.

For this reason I regard as an interesting and useful part of our system, and not as a subject superadded and independent of it, this portion of religious instruction. It is not only a part of the college system, but a portion of the special instruction which belongs to the department of the Applied Sciences; and it serves to bind together—founded as it is on the best principles of our nature—many pursuits and interests which might otherwise appear disconnected and incomplete. This portion of instruction is continued throughout the three years of the college course.

Such then is a general sketch of the plan of education which many of you are now commencing, and which others have already partially followed. As a plan, it is sufficiently distinct and comprehensive: it aims at one object which is kept constantly in view; it makes use of simple means which are throughout of the same kind.

Our plan is to prepare men for the ordinary business of life—not so much by forcing knowledge upon them, as by inducing them to acquire it. We believe that the kind of education we offer is not less adapted for the country gentleman than for the engineer and the architect. We think that the banker and the merchant would be the better for having had the training we offer; and we are confident that society would be greatly benefitted if some such plan were adopted in the education of the middle classes generally.

We appeal rather to the common sense than to the intellect, when we ask if such information as that we endeavour to teach is not likely to be useful—if such training is not adapted to practical men?

If this our plan is thus distinct and comprehensive, we may venture also to believe that it is kept constantly in view. We do not mean, indeed, to assert that it is talked about daily in the lecture-room, or that we individually endeavour to refer our instruction to it; but we do say that the system adopted is such as to demand and insure perpetual recurrence to it. Our scheme of lecture-attendance—the examinations held from time to time—the rewards offered in prizes and scholarships, may be mentioned as proofs of this: and we may safely point to the workshop as well as the lecture-room; to the factory inspected, and to the museum visited, as the most certain and convincing testimony to the uniform working of our plan.

The means that we adopt are also very simple. We require regularity of attendance; but we find no difficulty in enforcing order; we encourage the timid; we are anxious to the best of our power to assist those who help themselves.

And the result is seen at present in the satisfactory nature of our annual examinations, and will in time appear in the harvest of useful men who have gone forth from our ranks. Time is necessary to crown us with this reward; but indications are not wanting of our students in this department being likely to attain similar distinctions to those which have already characterised other departments in the College, the period of whose duration has been greater.

In bringing this address to a conclusion, it remains only that I point out once more the essential and peculiar features of the plan we have adopted, and the importance that each one of you should keep in view the unity of this plan while pursuing any subject that may seem to have a more engrossing interest than the rest. We desire to give an education essentially practical—technical, indeed, for some who may require it, but general and untechnical for the greater number. With this object in view, we insist much and pay great and continued attention to those elementary subjects of instruction which chiefly encourage and produce sound mental culture:—the elements of geometry of chemistry and of mechanics serving chiefly for this purpose, and being employed instead of the principles of grammar, elsewhere resorted to, as having more distinct application to the class of facts afterwards engrafted on this stock.

In order fully to benefit by our system however, you will readily perceive the necessity of limiting the pursuit of pure mathematics, which we wish you to employ as a means, not regarding it as an end. Do not therefore permit yourselves to dwell too exclusively on this subject, if you would advance to the ultimate objects we have in view.

The theoretical application of pure mathematics to natural philosophy is another subject to which we invite attention, and require you to obtain some proficiency. But let me warn you, as practical men, against the danger of pursuing in too great detail this portion of mixed mathematics.

It is the especial object of the instruction we give to send men out into the world, not to retain them in the closet. Study all those subjects that come before you minutely if you will, and by all means study them so as to have clear and accurate notions of what you are about; but regard them always in a practical light—refer them constantly to some immediately useful object—think of them as men of business rather than as philosophers.

There is, I believe, no danger of your knowledge in other departments of science becoming too contemplative; unless, indeed, you should be inclined to pursue chemistry, mineralogy, or geology, rather for the amusement they afford than for their distinctly practical results. With regard to my own science, I always have endeavoured, and always shall endeavour, to present it to you in its most practical light; and the pursuits of chemistry and mineralogy are so directly connected with the arts, and with mining and metallurgy, that few of you probably will be tempted to pursue these sciences as objects of exclusive research.

The remaining subjects of instruction are eminently practical, and need no warning of this kind.

Quitting for a moment any reference to the especial nature of the subjects taught, there are two errors diametrically opposed to one another, but towards one or other of which almost every person is occasionally tempted. These are idleness and over-exertion. It would be difficult to determine which of the two has been more fatal to the progress of the student. I need hardly tell you how much danger there is in giving way to the idea that when the immediate task is learned, idleness is permissible. In the schoolboy, indeed, we excuse this, because in most cases the mental effort requires to be succeeded by physical exertion; but for you there can be no such feeling. You must advance steadily, constantly, and incessantly, if you would attain that distinction and success which ought to be the object of your ambition. Relaxation no doubt is necessary, but your relaxation must not be idleness.

On the other hand, you will be tempted in your competition for the honours and prizes offered as the rewards of exertion, to pursue your studies with an unreasonable and excessive ardour, without regard to prudence and health. This is no less an evil than the opposite vice of sloth. You are no more justified in excess of this kind and in the indulgence of mental excitement, than you would be in the unreasonable indulgence of any other passion. Nor can you really benefit by this kind of intemperance. A steady and unwavering progress is most valuable, and most permanently useful; and you had far better fail in obtaining the prize than obtain it at the cost of health.

And now that you have been informed of the nature and extent of the education here afforded—what we offer you, and what we expect from you—my task, that of introducing you to your work, is for the present at an end. I have myself no fear as to the result in your cases individually; and whatever may have been or may be the toil and the anxiety of those who have superintended the growth of this department of the Applied Sciences, of which you are now members,—whatever struggles and difficulties we may have had in carrying out our views, with reference to the subject of general scientific education,—however slowly it may have taken root, and however it may have been checked by the apathy of those whose other occupations were too pressing to allow them to do justice to this,—we are all, I think, satisfied now that as a system it is established; and that we who have laboured earnestly in the cause may fairly expect to see the result in our days—although one of those to whom the system owes much, and who would have rejoiced to see its present success, has unhappily been removed from his sphere of usefulness before success dawned upon us. I cannot forbear here this allusion to our late lamented Professor of Chemistry,* for I feel that without his exertions we should not this day have been able thus to offer congratulation, as well as to express hope; and he would, I repeat, have been amongst those most rejoiced could he have seen his views thus far carried into successful operation.

* Professor Daniell.

REVIEWS.

Mathematical Physics; or the Mathematical Principles of Natural Philosophy: with a development of the causes of Heat, Gaseous Elasticity, Gravitation, and other great phenomena of Nature. By JOHN HERAPATH, Esq. London: Whittaker and Co., 1847. 2 vols. royal octavo.

It is not long since that a Mr. Isaac Frost proclaimed, trump et-mouthed, a discovery of the most stupendous importance—viz., that the Newtonian Theory was as untrue as it was blasphemous; that the sun was not the centre of our system, but revolved round the earth at the distance of about 20,000 miles; that the moon was a block of ice, distant 6,000 miles; and, "as to *the length of the diameter of the universe*, if any gentleman were to ask me that question," says Mr. Frost, "I should answer—'It is as long as GOD pleases.'"

Mr. Frost's objections to the theory of gravitation were certainly very plausible. "Newton," observes that astute philosopher, "accounted for the force which drives the earth up the ascending node of the ecliptic, but does not account for the force which rolls it down the descending node;" and again, "if the stars are infinitely distant, how is it that their light does not interfere to produce darkness?" This latter objection we consider especially profound,—an opinion which we the more confidently express for two reasons—first, because we entertain it in common with one of the most popular journals of the day; and secondly, because we can't understand it—a sufficient proof with most people of the profundity of an idea.

About the same time that the unscientific public was astonished by the theories of Mr. Isaac Frost—in opposition to Sir Isaac Newton—the scientific public was gratified by the discovery of a new planet, upon which no telescope had yet been turned—on which no eye had ever gazed; which, too remote and obscure to be apprehended by the faculties of sense, was reached by a grasp of intellect not unworthy of him who first interpreted the laws which made necessary the existence of that distant world. How rich must have been the reward of its silent and unobtrusive discoverer! How intense his scorn of the pedants who surrounded him! With what quiet mirth would he turn from their *sesquipedalia verba*, their "*hemihexatetrahedrons*" and jargon, to those cherished results of his toil, the final completion of his Principia! Day, in all her Indian magnificence, had for him less glory than the Night; for Night held the treasure he had staked years of thought to win. Mighty was his ambition—mightier his success.

Somewhere in the wide gap between these two great philosophers we would rank Mr. Herapath,—and in justice to that gentleman, be it observed, nearer to Mr. John Couch Adams than to Mr. Isaac Frost. If our author had succeeded in accomplishing all that the lengthy title-page of his work professes, we should consider him by far the greatest man of his age: profession, however, is not practice, and although we admit that some of the theories he has developed are extremely ingenious and supported by a great deal of beautiful reasoning, yet we confess we are not disposed to accede to the truth of any one of them—simply because they explain only a few, and seem to us quite irreconcilable with the greater number, of the phenomena of nature.

The cause which Mr. Herapath assigns for heat, gravitation, and the other molecular forces of the universe, is a very simple one—the assumed hardness and inertia of the molecules of matter; and the subject of our present review professes to be a general treatise on the action of forces, whether finite or molecular. The first part—on the action and laws of finite forces—is nothing more than a jumbled compilation of certain statical and dynamical propositions. Moreover, although the results of these propositions, which are all old acquaintances (such as to find the centre of gravity, centre of percussion, and the like,) are correct enough, the means by which these results are arrived at are very questionable, and to us in most instances wholly unintelligible. Mr. Herapath has adopted the very common error of assuming the fundamental laws of motion to be axiomatic;—no fact can be axiomatic which the mind can conceive to be otherwise than it is: but it is very easy to conceive the laws of motion to be different from what they really are; therefore the laws of motion are not axiomatic, and consequently depend on experiment and induction. In the theory of collision, Mr. Herapath is at least original:—having previously admitted that a perfectly hard body, such as he defines it, has never been the subject of experience, and moreover that other bodies, usually termed hard, with which we are acquainted, such as iron, granite, &c., are as distinct from perfectly hard bodies as rest is distinct from motion, he proceeds to argue on what would happen supposing two perfectly hard bodies to impinge on each other. He asserts that under such circumstances, the two bodies would each retrace their paths, with velocities equal but contrary to those which they possessed previously to impact. We do not attempt to disprove Mr. Herapath's assertion, but in lawyer style we set up a counter-plea or assertion of our own: we assert that two "perfectly hard" bodies, after impact, would polka together "for an hour by Shrewsbury clock," and then turn green,—and we defy Mr. Herapath to disprove *our* assertion.

To view the subject more seriously, the phenomena which take place during the impact of two ordinary bodies may be well illustrated by the following problem:—Suppose two balls, with masses A and B, to impinge directly on opposite ends of a spiral spring, the mass of the spring being neglected in comparison with either of the masses A or B.

Suppose a were the original length of the spring, x its length at time t from commencement of impact, x the space one end has passed over at time t. Then, since the mass of the spring is indefinitely small, the forces tending to compress it at both ends are equal. Let T be this force at time t;—then we have for the motion of A

$$\frac{d^2x}{dt^2} = \frac{-T}{A};$$

for the motion of B

$$\frac{d^2(x+z)}{dt^2} = \frac{T}{B};$$

$$\frac{dx}{dt} = c - \int \frac{T.dt}{A}.$$

Let u be the velocity A had at first, then $c = u$. $\therefore$ the velocity of A continually decreases, and at time t is diminished by a quantity $= \int \frac{T\,dt}{A}$; and the velocity of B continually diminishes by $\int \frac{T\,dt}{B}$

at time t, the velocities of A and B previously to impact being supposed contrary in direction. Let $x = b$ be the value of x when the spring has reached the limits of its compression; z then is a minimum. $\therefore \frac{dz}{dt} = o$;

$$\therefore \text{ if } x + z = x', \quad \frac{dx'}{dt} = \frac{dx}{dt}.$$

If, now, the spring has no power of recovery—*i. e.* if the force T, ceases, the balls will move on together with equal velocities, $\frac{dx}{dt}$ and $\frac{dx'}{dt}$. Also $\frac{dx}{dt} = u - \int \frac{T}{A} dt$; $\frac{dx'}{dt} = -v + \int \frac{T}{B} dt$; v being the velocity of B previous to impact.

$\therefore$ eliminating the $\int T\,dt$,

$$(B + A) \cdot \frac{dx}{dt} = Au - Bv.$$

This is the formula for the impact of what are generally termed hard, inelastic bodies—*i. e.* bodies of which the particles have no tendency to restitution after displacement. If, however, after $\frac{dz}{dt} = o$ the spring recoils with perfect elasticity, the integral $\int \frac{T}{A} dt$ during the time that z increases from $z = b$ to $z = a$, will $= \int \frac{T}{A} dt$ taken during the time z decreased from $z = a$ to $z = b$;

$$\text{but } \int \frac{T}{A} dt = u - \frac{dx}{dt} = u - \frac{Au - Bv}{A + B} = \frac{B(u + v)}{A + B};$$

$\therefore$ the final velocity of A will be

$$u - \frac{2(Bu + Bv)}{A + B},$$

which is the formula for the collision of perfectly elastic bodies.

The most important part, however, of the "Mathematical Physics" is that in which the author developes his theory of heat and the molecular constitution of gases; and it is but justice to him to observe that much of the first part of his work is confessedly a juvenile production. Whether his investigation of the motion of a crank, in which he has fallen into the common error of neglecting the mass of the connecting-rod, is to be reckoned among his youthful performances or not we cannot say,—we trust, however, for the author's credit, that it is. We now come to the theory of heat and the constitution of gases:—Newton conjectured that heat might arise from an intestine motion of the particles of matter, and that temperature might vary as the velocity of the particles. Mr. Herapath, on the other hand, supposes the temperature to vary as the momentum of the particles; and combining this theory with his idea of the perfect hardness of the particles—or rather, as we should say, their perfect elasticity—he shows very clearly and beautifully how the pressure of gases varies with their temperature; and how the specific heat of bodies multiplied by their chemical equivalents is constant. There are, however, many phenomena of heat, which appear to us utterly incapable of explanation on Mr. Herapath's theory;—we allude to radiation, conduction, and polarization. How is it that bodies which radiate the best conduct the worse, and *vice versâ?* And how are we to account for the intricate phenomena of polarization? Surely these facts depend on something more than a lawless motion of the particles of matter among themselves. That the particles of matter, or the nuclei of material forces, are continually in motion is highly probable—nay, almost certain; but what that motion is—on which heat, light, and electricity, with all their varied yet definite phenomena, depend—remains yet, we think, to be discovered.

Various theories of the molecular constitution of matter have, indeed, been put forth from time to time,—none, however, that merit much attention, with the exception of the undulatory theory of light; and even in this, the great result arrived at—viz. the form of the wave surface,—although it satisfies most, and has suggested some facts of polarised light, is deduced from considerations dynamically unsound. We may here observe that Fresnel (see "Airy's Tracts," p. 357), in determining theoretically the polarising angle of a reflecting surface, has adopted a hypothesis for the motion of the particles of ether nearly the same as that of Mr. Herapath.

In conclusion, we cordially recommend the work to those of our readers who have sufficient leisure and mathematical knowledge to do justice to the author, though we cannot help expressing a wish that Mr. Herapath had devoted half the time and ability to the mathematics of engineering that he has to the castle-building of hypothetical speculations, and we might then have had the pleasure of reviewing a work of less pretensions but of far more solid usefulness. The most profound mathematicians of the day with whom we have had the honour of conversing on the subject, shrink from the difficulties attending all theories of molecular constitution, and in their wildest dreams we believe have never so much as dared to hope for a solution of even one of those grand mysteries—"Heat, Gaseous Elasticity, Gravitation, and other great Phenomena of Nature."

Railway Locomotion and Steam Navigation: their Principles and Practice. By JOHN CURR, of New South Wales. London: Williams, 1847. 8vo., pp. 181.

"Oh that mine adversary had written a book," cried Job in bitterness of spirit. We, who are not nearly so patient as he, are induced by the perusal of the work before us to exclaim—Oh that mine adversary had to review a book! Mr. Curr has come all the way from New South Wales to have his bark and his bite at modern engineering! A man does not travel 16,000 miles for a trifle; and accordingly Mr. Curr bow-wows pretty loudly.

First, our excellent contemporary, the *Mechanics' Magazine*, comes in for a snarl. From "a careful examination of two volumes and two odd numbers" of that work, our author is satisfied that "the present actual and scientific knowledge of English engineers" is in a most deplorable condition; and so in order to enlighten them he resolved on quitting "a peaceful homestead in the fair clime of Australia," embarked on board the good ship "St. George," for England, arrived safely, and forthwith published the present volume. It is our private conviction that Mr. Curr is the COMING MAN who has been so long and so anxiously expected.

To attempt an intelligible analysis of his doctrines were as vain as to essay a systematic arrangement of the Sibylline leaves, or an interpretation of the oracular teachings of a Pythonissa. Science and satire, analysis and adventure, are so strangely intermingled that dim mortal vision frequently misses the line of demarcation. Mr. Curr sets off with a grave bit of theory about motion of fluids, or a pet doctrine of gravitation, and interrupts himself to tell a personal anecdote. As many "most disastrous chances of moving accidents" have befallen him as Othello, and they are set down in this book, in the very thick of philosophical propositions and algebraical symbols. Our author seems to entertain the idea of combining the truths of science with the "intense interest" of a melodrama. For example, he begins to talk about latent heat, and suddenly stops to tell a startling story of his father being on a certain occasion "reduced to the necessity of concealment in a wood for three days and nights to escape the fury of the populace." In another place, he records a dispute between himself and somebody at Norwich, which somehow or another induced him to go to Margate, where he "issued through the town a printed placard," &c. Further on he tells us that his father was disowned by his grandfather on account of a difference of opinion on engineering subjects, "and the letter to that effect was retained in his family for thirty years or more." Our author is as rich in family anecdotes as in scientific discoveries, and passes from the one to the other with surprising facility. Every reader of Hudibras knows that

> "Th' adventure of the bear and fiddle
> Is sung, but breaks off in the middle."

But the excursions and imaginative flights of the political satirist, Butler, are nothing to those of the philosophical satirist, Curr.

Poor Doctor Hutton comes in for a more than ordinary share of abuse. Various errors and inconsistencies in his theoretical views are pointed out. Hutton wrote at a time when the principles of mechanics, and especially the practical application of them, were much less understood than at present: and we are quite ready to accord to Mr. Curr the easily-acquired merit of having proved that Hutton is not infallible. He was a much better arithmetician than mathematician, but the time at which he wrote may excuse some of his inaccuracies—and it is but a pious task to avenge his memory by showing that his antagonist commits errors equally grave without the same excuse for them. For instance, Mr. Curr propounds various formulæ for calculating the motion of railway trains, assuming the modulus of friction to be constant; whereas the evidence of uniform experience shows that the resistance to the motion of the wheels on the rails increases very rapidly with increase of velocity. The percussions in passing over the joints of the rails, and the vibrating motion of the rails themselves, render necessary a great expenditure of power. And as these

percussions and vibrations, and other irregularities of the motion of trains, are always observed to be much greater at high, than at low, velocities, it is quite clear that till their relation to the velocity be ascertained it is impossible to make the speed of trains a matter of mathematical calculation. The *law* of resistance, or the degree in which the resistance increases with increase of velocity, has not yet been discovered, notwithstanding the efforts of numerous excellent experiments. The self-sufficiency with which Mr. Curr decries the labours of Mr. Scott Russell and others, who are usefully employed in the experimental investigation of the subject, is rivalled only by the ignorance of first principles displayed in the attempt to solve a problem of which the data are not given.

Patience and space would fail us to point out all his other errors—yet one or two instances may be cited. In one place he tells us that the consumption of coke necessary for the conveyance of a given load by a fast train is the same as by a slow one. "If the velocity be doubled," says he, "a given distance is passed over in half the time:" the supply of steam must be doubly fast in the second case, but will be required for half the time. Hence he concludes that in both cases the same quantity of steam (and therefore of coke) will be consumed—totally overlooking the fact that the increased resistance to the train's motion in the second case renders it necessary that the steam should be consumed in the cylinder at a greatly increased pressure. His notion is much the same thing as asserting that the easiest way of travelling fifty miles on horseback is to ride at full gallop.

In another place we are told that "the bite would be lessened on ascending a gradient according to which end of the engine might be moving foremost, as thereby the centre of gravity of the engine would approach or recede from the driving wheels." It were useless to attempt a serious refutation of such nonsense.

> "'Tis a pity when charming women
> Talk of things that they don't understand:"

and similar objects of compassion may be found among the sterner sex.

Here is another specimen of our author's mechanical ideas: "Actual collision of trains moving in opposite directions is a subject scarcely deserving of attention, but as there appears a vulgar notion amongst persons who ought to know better, that if two trains meet, the shock is proportional to their joint velocity, or to twice the velocity of each train; it may be said the shock sustained by each train is proportional to its velocity, and the same is true as respects each person conveyed in it." Does Mr. Curr mean to assert that the shock to each train is quite independent of the velocity of the other train?—that if a man ran against a moving cannon ball the injury sustained by him would merely be proportional to his own velocity, and not depend on that of the ball? If that were true, it is obvious that if he stood quite still he would receive no injury were a whole park of artillery fired at him; and, similarly, that when a train is at rest the passengers need not be at all alarmed at seeing another train drive full tilt against them.

To quit theory, let us take a specimen of Mr. Curr's practical knowledge. The following is a proposition for ascending very steep gradients. "Let the engine be stopped near the foot of such inclined plane—let the driving wheels be removed and a pair substituted being of such diameter as will enable it to ascend." Take off the driving wheels, Mr. Curr? Pooh, pooh, man! what if it were proposed to you to take off your head and substitute that of Newton whenever you came to a stiff bit of mathematics?

Divers other equally rare devices hath Mr. Curr for the improvement of railway locomotion. One especially there is, which is calculated to effect a complete revolution in engineering, but its nature is kept a profound secret. We are tormented with curiosity to find out what it can be, but, No—says Mr. Curr—I have told you a good deal for nothing, beyond the cost of buying and reading my book, but for this master invention I demand a far higher recompense. And then he offers to reveal it confidentially to a committee of the House of Commons—in fact, repeats the Warner story in a new form.

The work concludes with a magnificent peroration, of which the following is a fair specimen:—

"But who proclaims himself my critic—the shadow of a nonentity whose only knowledge of the subject is derived from the book he intends to criticise: no—it will be left to future ages to find the truth ..... The principles are ONE—so break one link of the vinculum, and down goes my book to the shades below. The philosopher and the mathematician have been boldly attacked: whether they will continue their prejudices I will not decide: but to convince a man that he has played the fool is not an easy task."

Here, at least, we entirely agree with our author. The "task" *is* difficult—so difficult that we relinquish it in despair.

Sketches, Graphic and Descriptive, &c., for a History of the Decorative Painting applied to English Architecture during the Middle Ages. By G. L. BLACKBURNE, F.S.A., Architect. London: Williams and Co., 1847.

Mr. Blackburne proposes to do for the polychromy of the middle ages, what has been done for that of the Egyptians, Greeks, and Arabs, and to give us a special work of reference for architects and decorators in all that relates to the coloured ornaments suited to works of the mediæval character. This is certainly essential at a time when the taste for such decoration is extending, and when buildings of a high class are in progress. We have had many books on Gothic carving, but few illustrations of painting in that style, and for the reason that until lately the production of illuminated books was very expensive. The new processes for printing in colours come most opportunely in aid of the extended study of the decorative arts. In the works by Mr. Jobbins and Mr. Colling many useful examples have been already given, and no doubt Mr. Blackburne will find many co-operators before he gets to the end of his series.

Mr. Blackburne's text does not seem to us to be of so much value as his plates, although he has undoubtedly taken much pains; but in the attempt to publish a series of examples he will lay the foundation for a history of decoration in this country. He is therefore not to be blamed because he does not shine so much as an historian, as he does as an artist. The state of art among the English before the time of Bede should be examined in comparison with Byzantine monuments, for it cannot be doubted that from Greece and what was then the Byzantine city of Rome these new arts were brought into England, as we have express testimony to that effect.

Mr. Blackburne begins his work, in fact, from the thirteenth century, when the construction of so many larger edifices, now existing, and the practice of painting on walls, as well as on tablets and hangings, gave a more durable character to the labours of the painter and decorator. In the first number we have a choir ceiling from Malvern abbey, with its details; a screen from Aldenham church in Hertfordshire, in the Perpendicular style; a plate of details from the tomb of Lord Bourchier, in Westminster abbey; wall paintings from the chapel of St. Erasmus at Westminster, from Tewkesbury, and from Rochester cathedral; and a lectern stand from Littlebury, Essex. The tiles we think may be dismissed very briefly, for they have already been copiously illustrated in special works.

It is a matter of much congratulation that we shall now possess a body of English works illustrative of mediæval art, and calculated to foster the growing taste for that style. In the works of Carter, Stothard, and Shaw, in those already named, and in works on tombs, furniture, glass painting, fonts, and tiles, the architect, and we may add the artisan, of the present day, finds resources in which his predecessors were wanting.

The Ecclesiastical, Castellated, and Domestic Architecture of England, from the Norman Era to the Sixteenth Century. By JAMES HADFIELD, Architect. Vol. I., Part 1. London: Williams & Co., 1847.

Mr. Hadfield has begun an undertaking, the completion of which will require a life of labour, if carried out in the spirit of this specimen. Having chosen the county of Essex as the first, he makes a review of the churches, pointing out all the positions valuable to the architect as examples, and illustrates them by plates full of dimensions and working details, and of a uniform scale. We know of no work, which, with such strictness of plan, has equal practical value.

Four parts are to form the volume devoted to the county of Essex, and these are to contain eighty plates of the churches and mansions and their fittings. We think Mr. Hadfield is undertaking more than is required at his hands in proposing to give plates of stained glass, which forms a special art, and the labour, time, and expense bestowed on which may perhaps deprive the architect of what he will value infinitely more—drawings such as those in the present number.

The text is of a very limited character, simply explaining the architectural features, with little antiquarian detail, the object of the author being to keep up the practical nature of the work, and to throw his strength into the plates. This is a very laudable endeavour, and though the price of the part is large, it is, on account of the number of plates, very cheap. We think, too, that Mr. Hadfield has decided rightly in publishing large parts like the present, rather than splitting them into monthly numbers with two or three plates. There is a certain appearance of completeness about the part even at present which seems to make it of a more practical character.

Mr. Hadfield apportions his labour according to the importance of his work. Some churches are without notice; others, like Danbury, with four or five plates. The author has carefully eschewed perspec-

tive views, and there are no elevations of buildings, but a museum, as it were, is formed of details so carried out, that working drawings would be scarcely wanted in copying these examples. The plates, which are filled as much as they can be, are designed simply to help the architect, builder, and workman, and explain themselves so fully that the text is scarcely required. Indeed, the book, on inspection, carries with it its own recommendation, and is likely to meet with such support as to enable the author to proceed with confidence in his praiseworthy undertaking.

A History of the Architecture of the Abbey Church of St. Alban's, with especial Reference to the Norman Structure. By J. C. BUCKLER and C. A. BUCKLER. London: Longmans, 1847.

This is a work of such commendable industry, and of so much interest, that we must reserve it for a longer notice in a future number.

HIGH-PRESSURE STEAM.

The greatest object remaining to be accomplished in navigating the ocean by steam, is unquestionably the *saving of fuel*, and this, to any great extent, can only be effected by using high-pressure steam expansively, by which not only *one-half* of the tonnage occupied at least will be liberated, but *one-half* the cost of the fuel will be saved. We need not expatiate upon the immense importance of such a reduction, both to the naval and commercial marine of this country, particularly where distant depôts have to be so frequently replenished, because that can be duly appreciated by every person practically experienced in steam navigation. But no sooner, however, is the proposition mooted, than a fierce fusilade is opened against so dangerous an innovation, which that is presumed to be,—as if any inherent property existed to render high-pressure steam more dangerous or destructive than steam of low-pressure. This, however, results from prejudice rather than from calm and dispassionate reasoning; in the face, too, of daily experience and the successful operation of hundreds of locomotives gliding over our iron roads at something like 60 miles an hour, notwithstanding the very high power employed, which marine purposes do not require,—that it is really gratifying to read your judicious and pertinent remarks in the case of the late explosion of the Cricket steamboat. [see *Journal*, p. 330.]

With properly constructed safety-valves, to limit the pressure with certainty, placed beyond the control of the engineman or driver (which is a matter of equal importance in both systems), high steam will prove as safe, nay safer than low-pressure, if generated in suitable boilers; which, we trust, we shall be able to show. We are not aware if there exists any collected record of the number of explosions which have occurred, distinguishing the class to which each belongs, together with the probable cause and circumstances attending them, beyond the transitory and imperfect accounts given in the news of the day; or we believe it would be found, that not only are the most destructive effects produced, but also that two-thirds, possibly three-fourths, are occasioned by low-pressure steam, or by boilers so denominated (see the frightful account of the explosion in the newspapers of to-day—October the 7th—as detailed before the coroner at Leeds). And what would have been the consequence if many low-pressure marine boilers had been subjected to the fool-hardy and reckless treatment practised on board the "Cricket?" Would they have resisted one-half the time those boilers did?—we presume to think not.

Marine boilers of the usual form of construction and magnitude are the worst to resist pressure; and, therefore, in examining the comparative safety of the two systems, we will assume that the boilers are of the same form—viz. cylindrical (where the tension of the metal is most perfectly applied), and the pressure in one to be four pounds the square inch, and that of the other to be fifty, while the thickness of metal in each shall be in the exact ratio to the strain: thus, multiply the pressure by the radius, and divide the sum by 400 (equal to one-tenth of the strength of the plate for every eighth of its thickness), and the quotient will express the thickness in eighths which the plates of each of the boilers should contain.

Thus, we have two boilers whose power of resistance in relation to their contents are exactly equal; hence, if the fifty pounds steam were to be doubled, the pressure would not be one iota more dangerous than the four pounds steam being increased to eight, and *vice versa*; consequently, in relation to strength, one boiler is as likely to explode as the other: but as neither is likely to take a flight if duly supplied with water, and their safety-valves be in good order, we will proceed to consider the result in case of neglect—first, with regard to a deficiency of water, and next to the valves becoming fixed. With respect to a deficient supply of water, the chance of an explosion would probably be pretty nearly equal, and so would be the force, from the larger volume necessarily pent up in low-pressure boilers; indeed, we are not aware that there is any distinction observed in this particular, but in effect the low steam may be assumed to be more disastrous from its scalding property, as you very properly remark, than high-pressure. In respect to the safety-valves, we have shown that each boiler is capable of resisting the doubling of the working pressure of its contents, or any other extent in the same ratio in an equal degree. Now, it is quite possible for a low-pressure valve to adhere to its seat so firmly as to resist the additional four pounds per inch, and even a much greater increase, ere an explosion ensue; but for a valve of a high-pressure boiler to resist an addition of fifty pounds per inch without being unseated, is scarcely within the bounds of probability. All boilers require careful and efficient superintendence most unquestionably, and casualties from neglect will sometimes occur without doubt; but under an equal degree of supervision and skill in construction, we think we are justified in the conclusion that high-pressure steam in regard to safety has the advantage.

The quantity of fuel saved depends upon the just application of the expansive principle: the usual practice is for the pressure in the boiler to be *constant*, and the amount of expansion varied by expansive gear, according to the exigencies of the service. To prove that this is an error, we have only to imagine a cylinder, say four inches long and one in diameter, with steam of four pounds cut off at one quarter its length and allowed to expand to four times its volume, which will exert a mean force of two pounds and a fraction; this we will assume to be the minimum working power of the engine. Now, if circumstances require the maximum power to be applied of four pounds during the whole stroke, it is manifest that a *four fold* amount of steam will be required, and expansion must be abandoned altogether to effect it when its saving effect is most requisite, as the largest amount of fuel is being consumed. Now, if we reverse these functions, by making the amount of expansion *constant*, and work with a *variable* pressure, it will be found that the steam required will be exactly in the ratio of the work done; thus, if we raise the pressure to *eight pounds*, and cut off the steam as before, we obtain a mean of over four pounds, with just double the quantity of steam, instead of quadruple as above, and of course at one-half the expense of fuel. The pressures here assumed for illustrating the two modes of application are not those, of course, which would be adopted in practice, but the result would be the same in effect if the maximum pressure were sixty-five pounds above vacuum, and the minimum one-half that amount, working with a *constant* expansion of eight or ten times its original volume.

Now that competition is so strong in rates of speed, every degree of pressure is employed and steam generated in all kinds of boilers, suitable or unsuitable; the temptation is so great to run dangerous risks for the sake of victory, that some power of control is become absolutely necessary—a matter, however, of no very difficult accomplishment, though it might be opposed by the proprietors, possibly, as exposing the secret of the doings in the engine-room, with regard to the *real* working pressure; but that is a matter of no weight, nor can it be honestly objected to or denied. We would suggest, then, that a competent person should have the power to inspect *all steamboats* periodically, as to the fitness and condition of the boilers in relation to their working pressure, and to see the following precautionary checks adopted—viz.: One safety-valve, at least, on each boiler, placed beyond the control of the engineer, except as to having the power of lifting it occasionally, to insure its duly operating; or by a slight easement effected at regular intervals by the engine itself, but no power of adding weight. Next, that two graduated gages be fixed in one case above deck; one showing the pressure of steam in the boilers, and the other the level of the water and the excess or deficiency in either case from the fixed working points on the scale. These gages to be open at all times for inspection to every person on board, and minutes made in the log at regular intervals in sea-going steamers, particularly during the night, stating the height of the water and pressure of steam. The sound working condition of these gages to be maintained at all times, and cases of neglect, or tampering with them in any manner, to be visited by a severe fine—perhaps fine and imprisonment, where so many lives are endangered, which would at once put an end to the reckless tampering with the pressure, and insure careful attention to the supply of water, and consequently safety to all on board.

C.

London, October 7, 1847.

FULGURITES AND FULMINARY TUBES.

We have found in a French periodical some remarks on the action of the electric fluid when striking the ground, which do not seem to have attracted much attention here, and which have led us to look into the subject. It is observed that in the beginning of the last century, a hollow tube was discovered, which formed branches, in the sandy plains of Silesia. This tube was placed in a museum under the name of an "arborescent fossil." Somewhat later, similar tubes were found in the neighbourhood of Paderborn, Dresden, and Munster, likewise in Cumberland, in Hungary, on the *dunes* near Bordeaux, and on the plains of Bahia in Brazil. We do not remember any specimens of this kind in the British Museum, although there is an extensive collection of meteoric stones in the mineralogical department. This suggests the propriety of a separate collection, which should include meteorites, fulgurites, minerals and vegetables affected by electric action, volcanic substances, &c. These would extend our knowledge of new branches of science, those of meteorites, geological action, and coralline growth.

All the localities in which fulminary tubes are found, although far apart,

have a similarity of character in the soil in which the fulgurites are found, having a fine sand, containing a large proportion of silex. In this sand the tubes are always sunk vertically. Their diameter varies from $\frac{1}{25}$th of an inch to 3½ inches, and the thickness of the coating or wall of the tube from $\frac{1}{50}$th of an inch to 1 inch. The diameter diminishes according to the depth of tube, particularly when the tube ramifies; and these ramifications are sometimes very numerous, giving the fulminary tube all the appearance of the root of a tree.

Some fulgurites have been found six yards long. The external surface of the tubes is composed of grains of sand cemented together; in the inside these grains are melted, vitrified, and mixed with little bubbles, forming a sort of pearl-grey enamel, with which the inner part of the hollow cylinder is lined.

In the Brazils, fulgurites have been found with facettes and completely vitrified, and in Cumberland a vertical fulgurite was found cemented to a porphyritic boulder, at a depth of eight yards. At this point the fulgurite deviated, going off at an angle of 45° and being about $\frac{1}{25}$th of an inch in diameter.

Though several hypotheses as to fulgurites have been formed, that of Dr. Fiedler seems best to meet the case. He has shown that these tubes are caused by the calorific action of lightning, which passing through siliceous sand, melts it in its way. This melted part becomes the inner wall or bore of the tube, and the outer wall is formed by the cementation of grains of quartz imperfectly melted, and joined by water in a state of vapour arising from the great heat developed by the lightning in its passage through the soil. This action of lightning has been determined on several occasions. On the 3rd of September, 1789, lightning struck an oak in the Earl of Aylesford's park, and killed a man who had taken shelter in the tree. On digging up the ground to erect a monument on the spot, a quantity of melted flint was found, and underneath where the poor man's stick had stood a vertical tube of melted sand. Some seamen having noticed lightning fall on the sandy isle of Amrum, off the Danish coast, found, on looking there, a fulminary tube. On the 13th of June, 1841, Dr. Fiedler found a similar tube in a vineyard near Dresden. This tube divided into three branches, and went to a depth of five feet. Artificial fulgurites have been formed by passing the electric fluid through siliceous sand. It may be observed that there are authenticated cases of rocks even being melted by lightning.

DRAINAGE OF LANDS.

Hydraulic engineering connected with the drainage of land becoming daily of such vast importance, induces us to present to our readers the very interesting discussion that took place last month, at a meeting of several highly intelligent and practical farmers and scientific gentlemen collected together at Drayton Manor, at the invitation of Sir Robert Peel. For the report we are indebted to the *Agricultural Gazette*.

Mr. Woodward said that in his opinion thorough drainage was the foundation of all good husbandry, without which manures and skill are thrown away. Some undrained land had come into his occupation, heavy land, which only produced 10½ bushels of wheat per acre; he immediately drained it 3 feet deep, subsoiled it, dressed it with burnt clay, and the first year obtained from it 51 bushels. He regarded the extensive burning of clay land as a most important practice. It rendered the soil so much more friable and convertible, and enabled the farmer to work it with much less horse labour. The effects of burnt clay upon all green crops was wonderful, a most important fact which could not be too strongly impressed upon the mind, as being very essential to the growth of corn, especially when consumed upon the land by sheep, eating at the same time a little oil-cake or refuse corn. He had not, however, found advantage in the use of Italian rye-grass, which he thought undeserving the praise it had received. The treading of sheep was highly advantageous to the wheat crop, provided the land was thoroughly drained and subsoiled. In order to secure the requisite amount of pressure, he had not only employed sheep, but horses, or even men, who he found could tread down land for 1s. 6d. an acre. He had also found advantage under some circumstances in the use of an instrument which he called a peg roller. This was formed of an elm-wood cylinder, studded with oak pegs about four inches apart; it proved to be a most effectual implement when drawn over the land, imitating as it did the consolidating power exercised by the feet of a flock of sheep. He regarded pressing down the land as opposing an invincible obstacle to the operations of grubs and wireworms. As to dead fallows, he entirely objected to them as wasteful and useless. On his clay land, when in turn for fallow, he planted vetches, and on his gravel, rye, and rye and vetches. For cleaning his stubbles after harvest he employed the implement called a two-edged "skim," which he strongly recommended as a cheap and most valuable modern invention. Mr. Woodward then pointed out what he regarded as the best manner of breaking up inferior pastures and converting them into arable; and concluded a very instructive speech by forcibly pointing out the absolute necessity of sending back to the land whatever is removed by a crop, and by expressing his entire agreement in opinion with Mr. Woolryche Whitmore, Mr. Huxtable, and others, that farming, properly and efficiently carried out, with capital and skill, may be made as profitable an investment as railways or other branches of commerce. Being asked whether he held his land on lease, Mr. Woodward replied that he did. But even if he had not, he, nevertheless, was of opinion that the expenses he incurred in the improvement of his land would have answered his purpose, for his improved wheat crop repaid those expenses immediately. As to leases, he attached little importance to them, provided there existed something like tenant-right, which would by law ensure to the outgoing tenant the whole unexhausted value of the improvements he had made; whether this was to be paid by landlord or incoming tenant was, he thought, of no importance. He trusted that the legislature would see the necessity of passing some enactment that would secure this right; otherwise it was not to be expected that tenants would expend their capital on land. Mr. Woodward having expressed a desire that Mr. Mechi would bring under the notice of the meeting the result of his high farming in Essex,

Mr. Mechi responded to the call. His practice in agriculture coincided so nearly with Mr. Woodward's, that it was only necessary to say that he grew alternately grain and root or leguminous crops, endeavouring as much as possible to grow wheat alternate years. He had originally drained his land 2 feet 8 inches deep, with pipes and stones, at a considerable expense; but since he had had the good fortune to meet with Mr. Parkes he had amended his errors, and was draining more deeply and effectually with pipes alone at one-third the cost. He rented some land adjoining his own; although he held but a seven years' lease, he drained it 5 feet deep with 1 inch pipes, at a cost of from 35s. to 50s. per acre. *He could not afford to deprive himself of the benefit of drainage.* He found it very unprofitable to farm such land undrained. The very first wheat crop remunerated him for the whole cost. The result of his improvements at Tiptree had been to double the produce of his farm and of his labour. A portion of it was formerly a swamp, not producing 5s. per acre. He had been entreated this year by a gardener in the neighbourhood to let those 4 acres to him, at an annual rental of 5*l.* per acre. He had removed 3½ miles of unnecessary banks and fences. Taking the arable acreage of the united kingdom, he thought they might safely dispense with 500,000 miles of unnecessary fencing, which, with its timber, displaced much food and labour. He considered the agriculture of this country in a very backward and unsatisfactory state compared with its manufactures. The agricultural mechanical appliances were rude, costly, and unprofitable. The farm buildings generally were bad, and uncentrically placed, causing a national loss of some millions; each ton of produce or manure costing an average carriage of 6d. per mile, renders the position of the buildings an important national consideration. Wagons were a most unphilosophical contrivance. It was quite clear that a long, light, low cart on two wheels, having an area of capacity equal to a wagon, and only costing half as much, was a much more sensible and profitable mode of conveyance. The question was not now an open one, having been thoroughly discussed and decided upon at the London Farmers' Club; therefore, the sooner the wagons were got rid of the better. With regard to the quantity of seed, his experiments (conducted now for three years and publicly recorded) had uniformly been in favour of thin sowing, say from 4 to 5 pecks of wheat, and 6 to 7 pecks of barley and oats. Some of the best farmers in his neighbourhood adopted this system successfully. It was highly important in a national point of view that this question should be settled; for if the quantities he had named were available, adieu at once to the necessity for foreign imports. It appeared to be admitted on all hands, that if a bushel of wheat vegetated, it was an ample seeding; and it was reasonable that it should be so, because if each good kernel produced only one ear, containing 48 kernels (and that was not a large one), there was no allowance for increase by branching or tillering, which we knew would take place to a considerable extent in well farmed land, containing an abundance of organic matter. Thin sowing delayed the ripening three or four days; consolidation by pressure prevented the development and action of wireworm and slug. He had found salt tended to a similar result. He salted all his wheats at the rate of 4 to 8 bushels per acre, and was determined to use much more. He knew a gentleman in Northamptonshire whose wheat crops could scarcely ever be kept from going down, until he used salt, which had effectually kept it standing. He (Mr. M.) salted the manure in his yards. He found that it sweetened them; he supposed it fixed the ammonia. It was a singular fact that whilst salt tended to preserve animal substances, it on the contrary rapidly decomposed vegetable matter. It was a cheap alkali of native production, costing only about 20s. to 30s. per ton, whilst all other alkalies were nearly eight times as dear. He strongly recommended the abundant use of bones, with and without acid, for root and green crops. It was evident that the bones formed in our growing animals, and in our cows from the produce of the farm, cost us 5d. per pound, or 45*l.* per ton. Now, if we could replace these, as we can do, by bone-dust, at 7*l.* per ton, it was clearly good policy to use them. He considered the waste of the liquid portions of the manure in most farm-yards a great national calamity. It was a great mistake ever to allow water to fall on manure. Water was a very heavy article. A thousand gallons weighed 10,000 lb., and were expensive to cart. He had heard farmers say when rain was falling, that that they should then litter their yards and make manure! Straw and water, in fact. He found in practice that animals did well on their own excrements and straw under cover; that they consolidated the mass until it was four feet thick, when it would cut out like a good dungheap, and be fit to carry on the land. But if rain water were allowed to wash this mass, an injurious effect resulted both to the animal and to the manure. He

could not afford to allow his manure to be well washed in the yards by drainage from the buildings, and afterwards to be washed, dried, and mangled by putting it out in heaps and turning over. It was a waste of time and of money. He found that his crops grew better with unwashed manure. A farm-yard should be like a railway terminus—covered in, but amply ventilated. There was comfort and profit in keeping everything dry. It did away with the necessity for water-carts and tanks: the liquid portions of the excrements being just sufficient to moisten the straw and burnt earth, or other absorbent material. He admired and practised, to a certain extent, Mr. Huxtable's system of placing animals on boards. It would answer in a compact farm with good roads, and in cold climates, to feed sheep in the yards on roots. In mild climates, and dry friable soils, it was most advantageous to consume the roots and green crops on the land by folding with sheep. There was no expense of carting off and carting back manure. Farmers had found out that the whole of the excrements were thus applied to the land, whereas in open yards with untroughed buildings, much was washed out and wasted. He hoped to see the time when tenants would consider it to be their interest (as in parts of Scotland) to pay 10s. per acre more rent for properly farmed, permanent, and convenient buildings and drainage, in lieu of the miserable and misplaced dilapidations of the present time. It was, no doubt, partly this difference that caused the Scotch rents to appear higher than our own. He was a decided subsoiler to the depth of at least two feet. It was a cheap and effective way of getting rid of strong rooted weeds, their crowns being generally just below the ordinary depth of ploughing. He did this in dry weather, and with the assistance of a heavy Crosskill roller and scarifier, made his fallows cheaply, quickly, and efficiently. He drilled his wheats at intervals of about 9 inches, so as to hoe them with Garrett's horse-hoe. It cost about 1s. per acre. It was far more expeditious and efficacious than the hand-hoe, and only cost one-fourth the amount. He strongly advocated the abundant use of oil-cake, and also of chalk on heavy clays deficient in calcareous matter. It had been proved that much more produce had resulted from oil-cake folding than where an equivalent amount was expended in corn. Good high farming was by far the most profitable; the starvation principle was a losing game. If we borrowed from the earth we must repay, or we should soon find an empty exchequer.

The Rev. A. Huxtable then rose and spoke to the following effect:—I think this by far the most interesting agricultural meeting that I have ever attended, on account of the variety of important views and practices which have been brought under our notice. For my own part, at so late a period of the day I must content myself with adducing a few facts that have come within my own farming experience, and defending one or two points of my farming practice which have been glanced at by the preceding speakers. As I see so many landed proprietors around me, I must beg permission to impress on them the duty of allowing their tenants to break up, under proper restrictions, the poorer lands now lying in grass. I think that I can show from my own experience that national wealth, the profits of the tenant, and the interests of the labourer, are deeply concerned in converting poor pasture into tillage. Thus, in my own parish, five years ago, there being many labourers out of employ, I obtained the consent of my landlord, Mr. Sturt, to break up the whole of the grass lands of a small dairy farm. It consisted of 95 acres, 10 of which only were then under the plough. When I entered on the occupation the farm supported 14 dairy cows, and grew 48 bushels of wheat and 40 bushels of beans. Now it annually produces 1,600 bushels of wheat, 40 head of cattle, cows, yearlings, and calves; and 100 sheep are fatted, and 80 pigs, and where 3¼ labourers were employed, 12 are now sustained all the year round. But the farm, gentlemen, labours under one embarrassment, such a one as I wish you all felt—such an accumulation of manure that, with the fear of laid wheat crops before my eyes, I know not where to place it. Allow me to detail briefly the steps by which this surely happy result has been brought about. I began at the beginning. I first drained the land; but of draining you have heard to-day so much, that I will only say that though it has been most successful, I yet heartily wish that I had earlier known Mr. Parke's deep drainage. My fields would have been far more economically and effectually rid of their bottom water. I tried when this was done to improve the herbage of some of the better pastures, but neither liming, nor sheep-folding, nor guano, enabling me to cut more than 15 cwt. of hay per acre, I pared and burnt it all, and cut down, by my kind landlord's leave, all the hedge-row timber, and grubbed up all save the boundary hedge, and have now a glorious farm. The next object was to provide for the permanent fertility of the soil by keeping a large amount of stock; for I hold that a farm ought to be made self-supporting as far as possible, and the purchase of manures should be regarded as only a temporary expedient —a necessary evil. My first effort to consume the green crops grown on half my farm was very expensive, and therefore unsuccessful; for with regard to the beasts, I was forced to purchase a ruinous amount of straw, and the sheep eating off the Swedes on clay land in winter puddled the fields, and were themselves amidst good food objects most pitiable. But when our principles are good, we must not allow slight difficulties to stop their application. I therefore determined to place my milch and store cattle on boards, as wood is an excellent non-conductor, and after a series of devices I have succeeded in making them tolerably comfortable, so that I am no longer dependent on my straw for the quantity of cattle which I keep. I am only limited in the number of animals which I keep by the amount of green food grown. In like manner, but with a variation of arrangement, the sheep were placed on small boards about 3½ inches wide, with an interval of about ⅞ inch between each, to permit the manure to fall freely into properly prepared tanks below. This is by far the most successful provision which I have made. Of 1,000 sheep so placed I have never had one lame. The pigs, in like manner, when fattened, sleep on a boarded stage above their feeding-place, and except in very cold weather, require no straw for litter. Thus I have dispensed with a large expenditure of straw, which my cereals (half the farm) could not sufficiently provide. But I hear some one exclaim, "What do you make of your straw?" First of all, a good deal is still required for bedding the horses, and the young stock which are in loose boxes; and as they never tread the green fields, they require a great quantity of white bedding. Secondly, a great deal is wanted for food, being mixed with the green leaves of the root crop and the mashed turnips. Thirdly, a ton per acre is used in making clover and vetches into imperfectly dried hay, with a due admixture of salt to arrest fermentation. These uses fully take up all the straw which I grow. I think the methods employed in preparing the manure from the "boarded" cattle deserve mention. First the liquid manure flows into large tanks; below them is another, which I call the mixing tank, for in it the manure is diluted with water to any degree which the state of the weather may require, the rule being that, in proportion to the increase of temperature must be the increase of dilution; *i. e.* the hotter the weather, the weaker should be the manure applied. In order to avoid the expensive and often injurious water-cart, I have laid down over the highest part of my farm a main of green elm pipe, of 2 inches diameter, bored in the solid wood; at every 100 yards distance is an upright post, bored in the same manner, with a nozzle. A forcing pump fixed at the mixing tank discharges along these pipes, buried 2 feet in the ground, the fluid with a pressure of 40 feet; of course it rushes up these pierced columns, and will discharge itself with great velocity through the nozzle; to this I attach first of all 40 yards of hose, and therewith water all the grass which it can reach. To the end of this hose another 40 yards of hose is attached, and a still larger portion of the surface is irrigated, and so on for as many 40 yards as are required. When enough has been irrigated at the first upright, the nozzle is plugged, and the fluid is discharged at the next 100 yards distanced column, and so on. For this application of the hose I am entirely indebted to that most able man, Mr. Edwin Chadwick; the green elm pipe is my own contrivance. The cost of the prepared canvas hose, which was obtained from Mr. Holland, of Manchester, was 1s. a yard; the wooden pipes cost me only 1s., and being underground they will be most enduring. By an outlay of 30*l.* I can thus irrigate 40 acres of land; and see how inexpensive, compared with the use of the water-cart and horse, is the application. A lad of 15 works the forcing pump; the attaching the hose and its management require a man and a boy. With these, then, equivalent to two men, I can easily water two acres a day, at the rate of 40 hogsheads per acre of the best manure in the world; I say *best*, because all chemists will assure you that the liquid contains the principal nitrogenous and soluble salts, and therefore is far more valuable than the dung, and it is plain enough to every man, though he be no chemist, that plants can only take up the manure in a liquid form. The principal use which I make of the hose is to water the clover, and, above all, the noble, but this day much-decried, Italian rye-grass. How hard Mr. Woodward was upon its soft sweet herbage! Yet his own excellent principle, that you must carry back to the land an equivalent for what is taken away, may be successfully alleged in defence of this most productive and nutritious of all grasses. It is certainly true that if you cut and carry away Italian rye-grass, and do not also carry back the manure made in eating it, you will not be able to grow wheat after it. But from my own observation I know that if, after each cutting, the hose immediately follows, you may cut it without wrong to the land as often as you like, and an amount of fodder will be obtained which no other plant can approach. It comes the earliest, and it grows the longest of all the grasses; and I feel confident that with such appliances as I have mentioned, you may secure fifty tons per annum of this milk-giving, fat-producing, muscle-making, grass. I refer to Mr. Dickinson, of Curzon-street, as an authority for growing at least this weight of green food, and I believe far more. That you can cut it, by the help of liquid manure, six times a-year, admits of no doubt. With regard to the manure made by sheep, as previously described, you will readily perceive its value if you reflect that when you give a flock in their house twenty tons of Swedes and their tops, you have minus only the increase of their bone and wool made during the three months of their happy confinement, all the inorganic and most of the organic ingredients of the crop being under the boards; in fact you may say that on the boards you have a fatted flock, and below the boards yet twenty tons of Swedes and their tops. I think that a good deal of misapprehension prevails respecting this mode of shed-feeding sheep, for you hear frequent comparison made on the superior system of feeding off crops in the fields. I have no doubt that in the summer months even fatting sheep will "do well" out of doors, and at the same time fertilise and consolidate the land; but I speak of feeding off winter crops by sheep which you wish to fat; and here I cannot think that the two systems admit of comparison, so superior are the results of the house and board system. But the conditions under which an animal is to be reared are quite different from those which you would observe in laying on fat. In the one case exercise is absolutely necessary; in the other case, the quieter and more still the creature is kept the better. Briefly, then, my own practice, which science surely justifies, is this—the greater proportion, about two-thirds, of my best roots are carted to the sheds, and given to the animals preparing for the butcher, whereas the tops and smaller turnips are fed off of by my breeding flock on the land, assisted by oilcake and

corn when necessary, and thus the land is rendered firm, and the ewes are kept in healthful exercise. Lastly, I must advert to the treatment of the dung made by the cattle and pigs. That on the boards is hourly swept down, and wheeled away to a long covered shed; contiguous to this is another shed containing a large store of burnt earth and other ashes. The dung is worked up with the ashes, and therewith is mixed the other manures, dissolved bones, soot, powdered chalk, &c. This, about 8 or 10 cart-loads per acre, is carted to the field ready for turnip sowing. The manure is drilled in by one of those that deliver moist manure, and thus eight acres can be got over in a day drilled on the flat. If the field is very poor, the drill goes over four acres in the morning without seed; in the afternoon the same quantity is again deposited in the same ruts, and the seed upon this double discharge. The advantage of this is, that the dung is never exposed to the drying of the sun or air; that the seed being deposited over a moist bed, germinates immediately in the driest season, and cares not for the fly, though for the prevalent grub it is certainly no remedy. The pig manure I consider the best of all; because one-half of the corn I feed them on is in the shape of beans, which contains the best mineral ingredient for growing Swedes, as I have endeavoured to set forth in my "lecture on manures." These, gentlemen, then, are the principal points of the practice which has brought me into that pleasing embarrassment of which I spoke before, and which I wish may befall you all—more manure than you can safely put on your arable land.

THE RECENT EXCAVATIONS AT POMPEII.

NAPLES, Oct. 2.—In the magnificent street leading from the ancient seashore, in the neighbourhood of the theatres, to the so-called crossway of the Fortuna, and thence in a direct line to the northern city wall, there has been excavated a house that surpasses in richness and elegance all that has been discovered previously. The space of the court-yard is open, has a mosaic pavement, and on the walls fantastic pictures of the richest and most tasteful style. At the sides of the atrium (court-yard) are small sleeping rooms, with the following wall paintings:—Polypheme, who receives a letter from Galatea by an amorino riding upon a dolphin; Venus occupied with fishing; a Narcissus; a few swimming gods of Love; a Victoria upon a car; and several landscapes. In the background of the atrium opens a tablinum (the reception-hall), with chequered marble pavement. On the walls of this room must have been wood paintings, as the spaces which they once filled are still plainly seen, as also the charcoal remains of those paintings. They were, perhaps, from the hands of those celebrated masters who, according to Pliny, preferred painting upon wood. At the side of the reception-hall is a dining-room, where are seen three large paintings of full-size figures. They represent Hercules with Omphale holding his club, and wrapped in the skin of the Nemæan lion. Next, Bacchus as a boy, and arm-in-arm with Silenus, on a car drawn by two oxen, and followed by Bacchantes. Thirdly, a Bacchanal procession of triumph. Here were also the Triklinian reposing beds, richly adorned with silver.

Behind the reception-hall is the garden, with a fountain at the end, which is adorned with mosaic and a small marble statue of Silenus. In the centre is the water reservoir, adorned with rich marble sculptures. This dwelling joins a second open atrium where the servants lived. Here was found a four-wheeled wagon with iron wheels and much bronze ornament. The kitchen contained many implements of bronze, and the traces of smoke were in many places still visible, after the lapse of eighteen centuries.

The dwelling had—what is very rare—second and third stories, to which led a wide staircase. Upon a small picture close to the staircase lies a letter with the (scarcely legible) name of the owner of the house, in oblique characters, and plainly indicating his rank. It belonged to the Decuriæ or senators of Pompeii.

The house has therefore been christened, Casa della Sonatrice, or dell' Ercole Ubbriaco. It is the newest excavation of importance

NOTES OF THE MONTH.

Royal Institute of British Architects.—The ordinary meetings of this Institute, for the session 1847-48, commence on Monday, the 1st inst., and will be continued as follows:—

1847	November	1	15	29
	December	13		
1848	January	10		24
	February	7		21
	March	6		20
	April	3		17
	May	1	15	29
	June	12		26

Lithography.—Messrs. Hullmandel and Walton have favoured us with some specimens of their new process of "stumping" in lithography, showing its advantages for representing architectural engineering, plans, and mechanical subjects. The tints approach nearer the nature of a wash than ordinary lithography, and the style offers the advantage of forming a complete subject with *one* printing alone, as from the facility with which skies can be executed for architectural drawings, it supersedes the necessity of a tint stone. The execution of the subjects on stone is, we understand, easy and simple as well as rapid, which we also deem of importance, as there is an economy of time as well as of actual cost.

Royal Artillery.—Some interesting experiments have been carried on during the past month in the practice range of the royal arsenal under the direction of the select committee. It had been suggested by Capt. Chadds, R.N., of the Excellent, naval gunnery ship at Portsmouth, that a great advantage would be gained in naval gunnery by uniting the shot and shell, and firing both at the same time. This suggestion has been tried during the past month, from 32-pounder and 8-inch guns, with remarkable success. The effect produced upon the bulkhead which serves as a target has been surprising, and affords some idea of the havoc that would be committed upon the hull of a ship of war under similar circumstances. The shell, although the lighter body, is said to enter the bulkhead first, and from its inferior specific gravity, strikes above the shot. Another great advantage appears to be the almost momentary bursting of the shell on concussion, the whole of those fired having burst either on striking the bulkhead, or on passing through it. The suggestion, although only intended by way of experiment, promises important results in naval warfare.

Mechanical Equivalent of Heat.—M. Séguin's experiments on the compression and dilation of gases confirm the mechanical equivalent of heat, as obtained by Mr. Joule. M. Seguin, however, reasons thus:—If to these facts be added all those where heat results from motion, such as a blow, compression, friction, change of condition, it will be clear that the two phenomena, identical in themselves, are only the consequences of a general law, which governs the motion of all bodies, and that the phenomena classed under the term caloric, are nothing more than the effects of motion. This principle admitted and properly understood, involves a modification and a vast improvement in the steam-engine. Steam may be said to be used between certain limits of pressure, say equivalent to a fall of temperature of 80°, and on being then condensed or allowed to escape, it is evident that it still contains about 660° of temperature, which is not utilized. By retaining this same steam, and restoring to it at each stroke of the piston the quantity of heat it lost to produce the motion, a complete and immense change in the steam-engine would result.

Metal for Clocks.—M. Laugier communicated to the Academy of Sciences, Paris, the result of a series of experiments with a view to ascertain the proportion of metals to be used in clocks in order to establish a perfect compensation. Hitherto, although very large sums have been expended in experiments for the production of compensation clocks to keep true time, no really satisfactory result has been arrived at. M. Laugier declares that perfect compensation may be gained by employing the following metals, and in the following proportions: iron, 100; copper, 135; zinc, 109; platina, 147.

Atmospheric Rays—Colours of the Horizon.—A paper was likewise received from M. Choron, on the peculiar colours visible on the horizon before the rising and after the setting of the sun. These colours of orange, yellow, red, green, and blue have hitherto been ascribed to atmospheric absorption of certain coloured rays. M. Choron ascribes them to the earth acting as a screen, and shutting out the whole of the white light above the horizon. He gives a series of optical experiments in support of his opinion.

Fortifications of the Southern Coast.—It is reported that, in consequence of a determination of government to put the whole line of the southern coast into a more efficient state of defence, there are to be several powerful batteries erected along that stretch of land commencing at the Castle port at Dartmouth, at the harbour's mouth, to the Start Point; and that the men now on the Coast-guard duty will be regularly trained and augmented in number, so as to constitute a disciplined body for the immediate duty, if required to work the newly-formed batteries.

Value of Land reclaimed from the Sea.—A few days ago were offered for sale, by the Nene Outfall commissioners, at Wisbech, 960 acres of land, in 27 lots, being their portion of between 3,000 and 4,000 acres gained from the sea, by the completion of their great work. The lots varied from 7 acres to 180; and the reserved bid varied from about 45*l.* to 80*l.* per acre; and though none of the lots were actually sold at these prices, above 60*l.* per acre was bid for one lot, containing 103 acres, and for some of the smaller lots higher prices were offered. It is but a few years ago that the whole of this valuable land formed the bed of the Wisbech river, and from the rapid deposits now going on beyond the barrier bank, another portion of from 3,000 to 4,000 acres may be added to *terra firma* in the course of a few years.

The Law of Atmospheric Resistance.—Professor Davies of the Royal Military Academy, has promulgated in the *Mechanics' Magazine*, the following law of atmospheric resistance (the atmosphere being homogeneous within the limits of the problem) to the flight of a projectile:—"If v be the velocity of a shot at any point in its path, and P be a constant depending on the physical condition of the atmosphere; then the resistance of the atmosphere to the progress of the shot will be $P\left(\frac{fx}{e}-1\right)$: and fx is such a function of x as to vanish with x, and which is under ordinary conditions but slightly different from x itself. In fact, I am led to think that the errors arising from so taking fx are so small as to be less than the probable errors of experiment, as this class of experiments has been hitherto made."

The Eclipse.—The meteorological observations made at the Cambridge observatory during the eclipse on the 9th October have been published, as follows: "The changes in the barometer and hygrometer were very small, but sufficiently considerable to show them to have been in some measure affected by the phenomenon. The observations were taken at intervals of from 10 to 15 minutes. At 6h. 0m. the barometer read 29,933 in., and until the commencement of the eclipse showed an inclination to fall. At the time of the greatest obscuration, it remained stationary, and immediately after it continued to ascend; finally, at 8h. 45m., it read 29,963 in., having thus ascended 0,030 in. in 2h. 45m. With three common thermometers, one with the bulb blackened and exposed to the sun's light, another with plain bulb in same position, and the third in the shade, the readings were plainly affected, though to a small amount, remaining mostly stationary as the sun became obscured, and varying rapidly as the phenomenon passed off. With hygrometers exposed to the sun's light, and in the shade, the differences were uniform, following the same range as the common thermometers. Owing to the moisture in the atmosphere, the wet and dry bulb readings were nearly the same, the differences being at commencement of eclipse—Wet below dry, 0·5 deg.; at greatest obscuration, 0·4 deg.; and at termination, 1·0 deg."

New Railway Carriage.—Messrs. Adams, of Fairfield Works, Bow, have just constructed some improved carriages for the North Woolwich branch of the East Counties railway. They are 40 feet in length, and 9 feet in width; the extra width being gained by building the carriage frames to the width of the ordinary step-boards. More is thus accomplished on the narrow than has yet been on the broad gauge, where the carriages are only 8 ft. 6 in. in width, by 28 feet in length. The extreme axles are 30 feet apart, and being on eight wheels, these carriages are obviously safer than those on six wheels or on four. Notwithstanding their length, they will pass a curve of 200 feet radius by means of the flexibility and arrangement of the springs, which permit the wheels to traverse laterally. The buffer heads are also made to radiate with the springs or curves, so that they press firmly under all circumstances. The carriages are fitted up in four compartments; one first-class with couches all around, and a table in the centre; the other three second class. They will carry about 100 passengers.

Obituary.—Mr. Cottingham, the architect of several cathedral restorations and other public works, died on the 13th ult., at his residence in the Waterloo-bridge-road.

Death of Vasques.—Senor R. Vasques, member of the order of the Jesuits, and of the Academy of Fine Arts, the most able architect and engineer in the Peninsula, has just died in Spain. He entered the order of St. Ignatius, but continued ardently to pursue his profession, in which he was extremely successful. He was engaged in the immense undertaking of opening a tunnel in the mountains of Guadaran, a much more difficult task than even the most celebrated tunnel of Europe, when he was suddenly attacked by an illness which carried him off.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM SEPTEMBER 24, TO OCTOBER 21, 1847.

Six Months allowed for Enrolment, unless otherwise expressed.

Charles Hancock, of Brompton, Middlesex, gentleman, for "Improvements in the preparation of gutta percha, and in the application thereof, alone, and in combination with other materials, to various manufacturing purposes."—Sealed September 24.

Thomas Moore, of Burnley, Lancaster, for "certain Improvements in looms for weaving."—September 30.

William Edward Newton, of Chancery-lane, Middlesex, for "Improvements in machinery for the manufacture of nets and netting." (A communication.)—Sept. 30.

Richard Johnson, of Manchester, wire manufacturer, for "certain Improvements in the manufacture of wire cloth."—Sept. 30.

Charles de la Salzede, of Paris, gentleman, for "Improvements in the brassing and bronzing the surface of steel, iron, zinc, lead, and tin."—Sept. 30.

Robert Hawkins Nicholls, of Thuriby Grange, Bourne, Lincoln, gentleman, for "Improvements in machinery for distributing corn and other grain on land, and also improvements in giving motion to agricultural and other machinery."—Sept. 30.

Ignacio de Barros, of Lisbon, Portugal, gentleman, for "Improvements in machinery for making lasts for boots and shoes, butts or stocks for fire-arms, and other irregular forms." (A communication.)—Sept. 30.

Charles Jay, of Bathurst-street, Hyde-park Gardens, Middlesex, gentleman, for "certain Improvements in apparatus for evaporating and concentrating saccharine and saline solutions, and which may be also applicable to the evaporation and concentration of vegetable and other extracts."—Sept. 30.

Pierre Auguste Bassaume, of No. 11, Rue du Creissant, in the City of Paris, gentleman, for "a new process for the preparation and engraving of plates, adapted to the printing of cotton stuffs, paper, and other substances."—October 7.

Nathaniel Fortescue Taylor, of Vauxhall Walk, Lambeth, engineer, for "Improvements in machinery for printing and staining paper and other fabrics."—October 7.

Joseph Wye, of Alfred Place, Saint George's, Southwark, engineer, for "Improvements in machinery for driving piles and raising earth and fluids."—October 7.

James Pearson, of Montague Terrace, New Cross, engineer, for "Improvements in locomotive engines and carriages."—October 7.

Alexander Bain, of the Wilderness, Hampton Wick, gentleman, for "Improvements in musical instruments, and in the means of playing on musical instruments."—Oct. 7.

Sir Samuel Brown, knight, of Vanbrugh Lodge, Blackheath, Kent, in Her Majesty's Navy, for "Improvements in propelling and steering vessels, and improvements in the mariner's compass."—October 7.

George H. Dodge, of Attleborough, in the State of Massachusetts, of the United States of America, for "certain new and useful improvements in machinery for spinning and winding yarn."—October 7.

Thomas Hunt Barber, of King-street, Cheapside, gentleman, for "Improvements in machinery for propelling vessels." (A communication.)—October 7.

John Tyrrell, of Great Ormond-street, Queen-square, Middlesex, esq., for "certain Improvements in the manufacture of elastic fabrics from vulcanized indian rubber, gutta-percha, or certain fibrous materials." (A communication.)—October 7.

James Hartley, of Sunderland, glass manufacturer, for "Improvements in the manufacture of glass."—October 7.

Jules Jean Baptiste Martin de Lignac, of Portland-street, in the county of Middlesex, gentleman, for "Improvements in preserving milk."—October 7.

Richard Fell, of Winchester-street, London, engineer, and James Fell, of Ostend, in the kingdom of Belgium, gentleman, for "certain Improvements in obtaining and applying motive power."—October 7.

Charles Frederick Ellerman, of Brompton, in the county of Middlesex, gentleman, for "certain processes or methods of rendering feculent, excremental, and other matters inodorous and disinfecting, and also of retarding the putrefaction of animal and vegetable substances, and certain chemical re-agents employed in the said processes or methods."—October 7.

Matthew Townsend, of the borough of Leicester, framework-knitter, for "Improvements in the manufacture of looped or knitted fabrics."—October 7.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for "certain Improvements applicable to the construction of floors and other parts of buildings, and also to certain kinds of furniture and fittings for buildings."—October 7.

Pierre Antoine Joseph Dujardin, of Lille, in the kingdom of France, doctor of medicine, for "Improvements in electro-magnetic telegraphic apparatus."—October 7.

Matthew Pierpoint, esq., of Worcester, for "certain Improvements in the distribution of artificial light."—October 7.

Samuel Cunliffe Lister, gentleman, and Isaac Holden, worsted-spinner, both of Bradford, for "Improvements in carding, preparing, and spinning wool and other fibrous substances, and also in making heald and Genappe yards."

Sir John Scott Lillie, of Fulham, in the county of Middlesex, knight, for "Improvements in machinery applicable to tillage, and for agricultural purposes."—October 14.

Thomas Horne, of Birmingham, for "certain Improvements applicable to carriage windows."—October 14.

John Thang Harradine, of Hollywell cum Needingworth, in the county of Huntingdon, farmer, for "an Improved agricultural instrument for preparing land in various ways for agricultural purposes."—October 14.

David Fisher, of Clerkenwell Green, Middlesex, for "certain Improvements in the manufacture of boots and shoes."—October 7.

Francis Lloyd, of Snow Hill, in the county of London, tobacco manufacturer, for "certain Improvements in the preparation and manufacture of tobacco."—October 14.

Matthew Curtis, of Manchester, machinist, for "certain Improvement in machines used for preparing to be spun, and spinning, cotton and other fibrous substances, and for preparing to be woven and weaving substances when spun."—October 14.

Bartholomew Beniowski, of Bow-street, Covent-garden, Middlesex, for "certain Improvements in the apparatus for and process of printing."—October 14.

Joseph Maudslay, of Lambeth, Surrey, for "certain Improvements in the manufacture of candles, parts of which improvements are applicable to the manufacture of other moulded substances."—October 14.

Alfred Vincent Newton, of 66, Chancery-lane, Middlesex, for "an Improved machinery for blooming iron."—October 14.

Arthur Wall, of India-row, East India-road, Middlesex, for "a new or improved apparatus for a method of separating oxides from their compounds and each other."—October 14.

Robert Stirling Newall, of Gateshead, Durham, for "certain Improvements in machinery for grinding grain, paints, and other substances."—October 14.

Patrick Playfair, merchant, and Laurence Hill, Jun., civil engineer, for "Improvements in the manufacture of sugar."—October 21.

John Ridgeway, of Caldon-place, Stafford, china manufacturer, for "certain Improvements in the manufacture of paste boxes, and other similar articles, in china and earthenware, or other plastic materials."—October 21.

William Gosswych Gard, of Calstock, Cornwall, engineer, for "certain Improvements in machinery and implements for boring and sinking."—October 21.

Robert Richardson Banks, of Great George-street, Westminster, for "a new method of artificially curing and preserving the berries of coffee by a drying apparatus."—October 21.

Edward Tattersall, of Newmarket, land surveyor, for "Improvements in making communications from one part of a railway train to another."—October 21.

Brooke Smith, of Birmingham, manufacturer, and Richard Ford Burges, of the same place, for "a certain Improvement or certain improvements in apparatus for filtering."—October 21.

James Beville, of Walworth, Surrey, for "certain Improvements in conveying goods and passengers on railroads, parts of such improvements being applicable for working or driving other descriptions of machinery."—October 21.

Richard Shaw, of Gold's Green, West Bromwich, Stafford, railway bar finisher, for "Improvements in the manufacture of wrought-iron railway bars and railway chairs."—October 21.

Charlton Henry Sloman, of St. Martin's-lane, Middlesex, for "Improvements in apparatus used for ironing."—October 21.

Thomas Forster, of Streatham, Surrey, manufacturer, for "Improvements in combining gutta percha with certain materials, and in the application thereof to waterproofing fabrics and in moulding various articles therefrom."—October 21.

A QUERY.—Suppose (P) pounds raised one foot high per minute represented the power required to roll a certain cylinder over a certain uniform inflexible road at a given rate. Also suppose (p) pounds raised one foot high per minute represented the power required to crush a certain uniform substance placed equally throughout upon that road. [That is, the power required to crush just so much of that substance in any given time as the cylinder came in contact with during that time].—*Question.* Would (however great the diameter of the said cylinder, and however great its weight) as much power as ($P + p$) pounds raised one foot high per minute be required to move the said cylinder on the said road over the said substance at the given rate, that substance being crushed thereby?

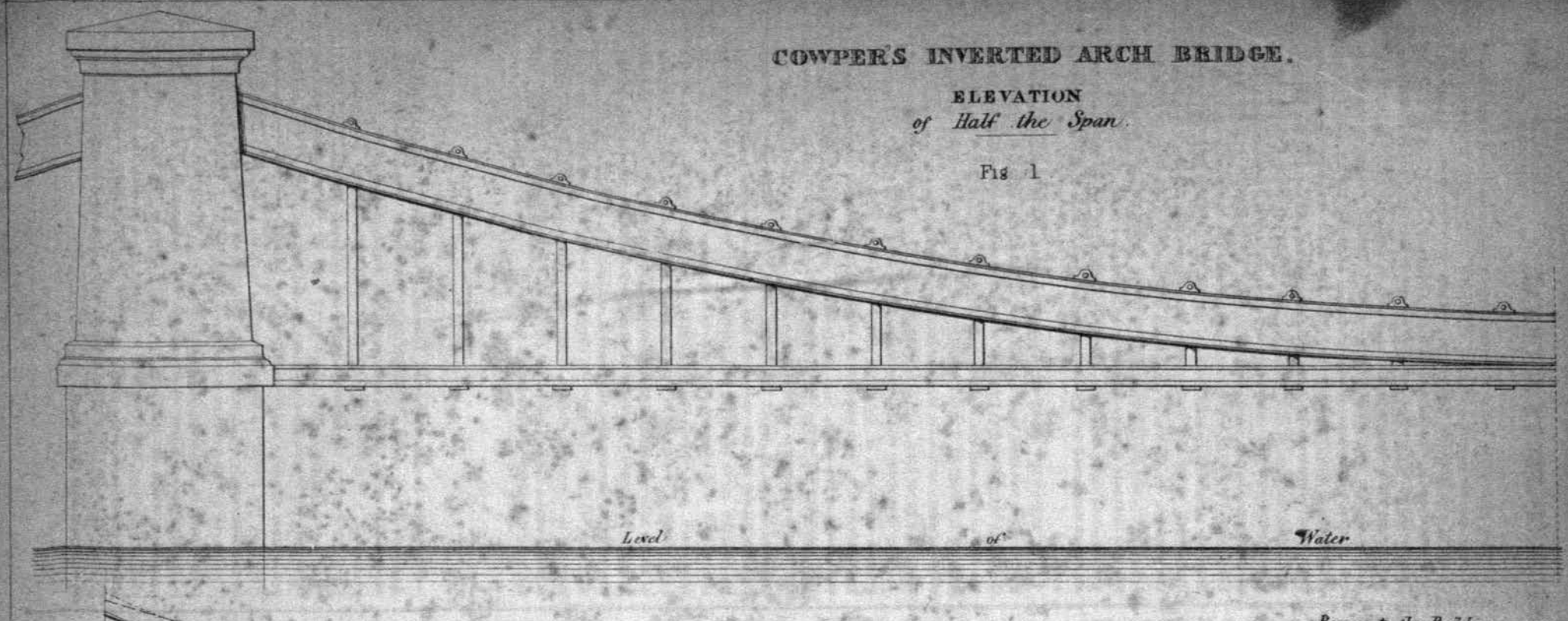
J. W.

PLATE XVIII

COWPER'S INVERTED ARCH BRIDGE.

ELEVATION
of Half the Span.

Fig 1.



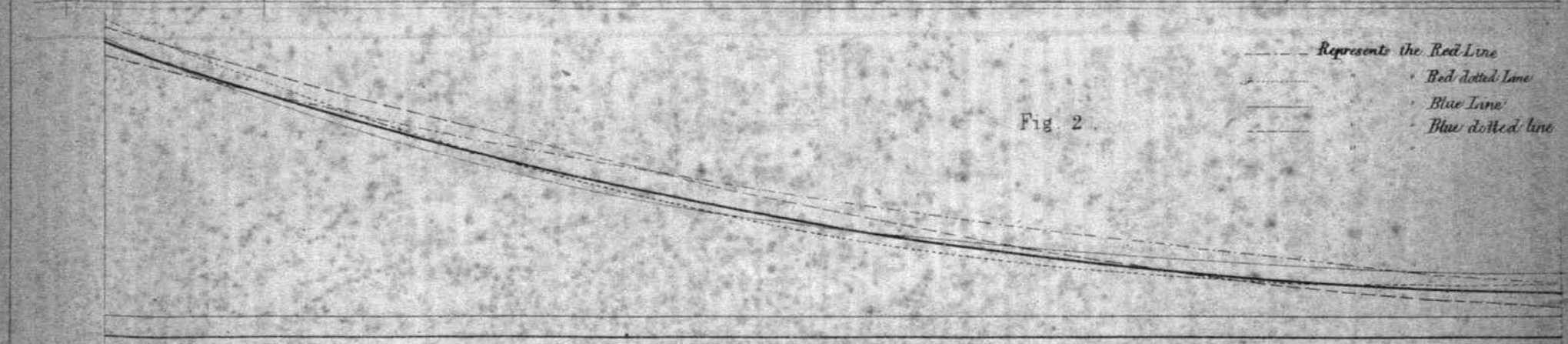
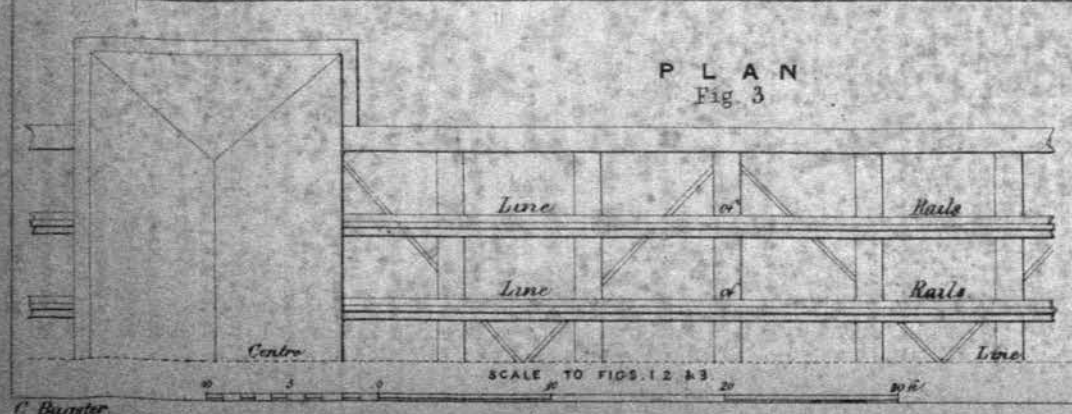
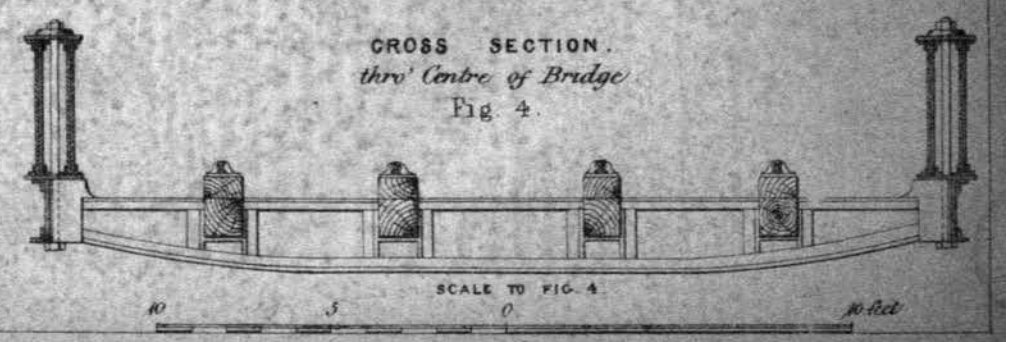


Fig 2.

PLAN
Fig 3.



CROSS SECTION.
thro' Centre of Bridge
Fig 4.



C. Baigster

RAILWAY SUSPENSION BRIDGE.

(With an Engraving, Plate XVIII.)

At the last meeting of the Institution of Mechanical Engineers, held at Birmingham, a paper, by Mr. A. E. Cowper, of the London Works, was read, "*On an Improved Suspension Bridge for carrying a Railway, and for other purposes.*"

In bringing before the Institution of Mechanical Engineers a paper on a peculiar form of bridge, I ought, perhaps, to apologise for introducing matter which may by some of our friends be thought to belong more strictly to our civil brethren; but possibly before the conclusion of the paper, I shall have anticipated any objection which might have been made on that score by showing, in point of fact, that I have only been explaining a piece of boiler-maker's work, and which may certainly be considered to be far enough removed from civil engineering. The object of the present paper is to call the attention of engineers, and railway directors generally, to a mode which I have invented of constructing suspension bridges in such a way that they shall not be thrown out of shape, or in any way distorted, by the weight of a passing load, whether it consists of a railway train or only of the ordinary traffic of a common road. It is well known that suspension bridges are decidedly less costly than any stone bridges, and we may add than most iron bridges, when the span is at all above the length of an ordinary girder; and although many persons have turned their attention to them, particularly with regard to their use on railways, I am not aware that any suspension bridge has ever been made, or proposed, that was at all competent to carry the weight of a railway train in motion, or, in other words, that should be safe as a railway bridge. My attention was particularly called to suspension bridges by the proposal of carrying a railway over the Hungerford-bridge, or over a bridge placed alongside of it; and it appeared to me that the weight of a passing train would so move and distort the chains as to cause the road very soon to get out of order, if not actually to give way; and I then schemed the plan of making a chain of such depth as to include any alteration in the curve of the strain that might take place.

The curve which the chains of an ordinary suspension bridge takes is well known to be a catenary, or rather a curve between a catenary and a parabola; it would be a true parabola if all the weight were in the platform, and a true catenary if all the weight were in the chain. As, however, the difference between the catenary and the parabola is very slight indeed in that portion which would be used for a bridge, we may assume it to be a catenary for all practical purposes. Now, on loading an ordinary suspension bridge with even a small weight, it at once assumes a different curve (unless the weight be equally distributed over the bridge,) and if the weight be large, it will assume a very different curve; so much, indeed, will the form be altered as to injure or strain the material of which the platform or road is composed. Now, it is evident that, if the road has to distribute the weight, it must be a very strong and stiff beam, or, in fact, a girder of the full length of the bridge; and the strength of this girder would very nearly be equal to carrying a quarter of the weight of the load in the centre; it is, therefore, evident that the plan of forming a stiff platform or road for a railway suspension bridge, although by no means impossible, must be at least half abandoning the suspension principle, and be the cause of greater outlay. The plan of keeping the road in shape, by distributing any weight that might come upon it, by means of strong diagonal ties, was the first idea that I had; but it will be found by calculation that these diagonals would have to be very strong, and of considerable height, thereby causing the total depth of the bridge to be much greater. But the plan on which I propose to construct suspension bridges capable of carrying railway trains without being in any way injured thereby, is simply to construct the chain of such depth as to include the curve of strain when the weight is placed on the bridge in the most unfavourable positions. With this object I construct the chains of boiler plate of considerable depth—say three or four feet, or more—and rivet the whole well together without any moveable joints, or separate links, and at the top and bottom edges of the chains (I still call them chains, that I may be clearly understood) I rivet or otherwise attach bars, either flat, half-round, or angle iron, so as to give an accumulation of metal at those parts, and at the same time to render the edges of the chains perfectly secure against any tendency to rip or tear.

In the engraving, fig. 4, it will be observed that there are two chains, each 4 feet deep, which support the ends of cross wrought-iron girders, in the position of sleepers, each chain being composed of four boiler-plates, riveted together in pairs, each plate being three-eighths thick, and at the top and bottom edges there are securely rivetted strong angle irons. The suspension bars hang between the two pairs of plates forming the chain, and are supported by a small saddle, which bears on the top edges of them. The ends of the cross wrought-iron girders are firmly secured to a light rib of boiler-plate, which runs along each side of the bridge, as shown in the cross section of the bridge; the lower ends of the suspension-bars are secured to the ends of the girders, with means of adjustment, so that the road may be trimmed perfectly level when the bridge is fixed. There are also light diagonal ties introduced, as shown in fig. 3, for more perfectly staying the road to the chains, particularly in case of the breaks being applied whilst the train is passing over the bridge. The rails, either of the ordinary form placed in chairs, or of that form commonly called the bridge-rail, are supported on balks of timber scarphed together, which run longitudinally throughout the bridge, and these are supported by short balks of timber running from girder to girder, immediately under the first. There are a series of diagonal ties placed in the platform, as shown in plan, fig. 3. These act as a means of stiffening the platform, and preventing any vibration or shaking of the parts. There are also diagonal ties or stay-rods, by which the bridge is prevented from moving or swinging sideways. They are attached to the piers, and are very similar to some used by Mr. Brunel, senior, in a bridge at the Isle of Bourbon.

The engraving shows a bridge 200 feet span, having the cross girders eight feet from centre to centre, and the chains four feet deep, which depth has been arrived at by actual experiment; the weight of the road from one line of rails and the train is one ton per foot run, and the weight of a train of locomotives I have assumed at one ton per foot run, and this is allowing some margin for the continued growth of locomotives; and I have taken as a proof load, two tons per foot run; thus the weight of the load, or disturbing cause, will be just double the weight of the bridge. I find the greatest distortion of the curve strain takes place when the bridge is only half loaded—*i. e.*, from one end to the centre; the curve then approaches the bottom of the chain, very nearly in the centre of the loaded half, and approaches the top of the chain in the centre of the unloaded half, whilst at the piers it approaches the top at the loaded end, and the bottom at the unloaded end, as shown by the dotted lines in fig. 2. Again, if the same load be placed in the centre of the bridge (covering one-half of the length), the curve of strain will approach the bottom of the chain in the centre, and will approach the top of the chain at very nearly one-fifth from each pier, whilst at the piers it will be near the centre of the chain, but rather above it. Take one more case, and we shall have disposed of all the heavy disturbing tendencies—viz., that of the ends loaded, and the centre left unloaded; the curve of strain will then approach the top of the chain in the centre, and the bottom of the chain at about one-sixth from each pier, whilst at the piers the strain will be slightly above the centre. I may add that, when the bridge is fully loaded throughout, the curve of strain is in the centre of the chain, throughout its length. I propose to call bridges made on this plan, "Inverted-Arch Bridges."

Photogenic Experiments.—M. Claudet, in a paper lately read at the *Académie des Sciences, Paris*, containing an account of various photogenic experiments, states that the solar spectrum is endowed with three different photogenic actions, which correspond with three groups susceptible of being attributed to the three groups of red, yellow, and blue rays. These three actions have distinct characters; each of the radiations has the effect of fixing the vapours of mercury in Daguerreotype plates, but they are in other respects so different that they cannot mingle or assist each other; on the contrary, they destroy each other. The effect commenced by the blue rays is destroyed by the yellow and red rays, and that which is produced by the red rays is destroyed by the yellow. The effect of the yellow rays is destroyed by the red, and that of the last two is destroyed by the blue rays. These changes appear to indicate that the chemical compound which covers the plate remains always the same under the various influences, and that there is no separation or isolation of the constituent principles. By a proper application of this theory, it will be possible to efface any image upon a plate, and yet leave it in such a state as to receive a new impression.

WORKING STEAM EXPANSIVELY.

When a steam-engine is working at any given speed, the pressure on the crank-pin is equal to the pressure on the piston resolved into the direction of the length of the connecting-rod, minus the force of inertia of the reciprocating parts when their velocity is increasing, or plus the *vis insita* of those parts when their velocity is decreasing:—it is required to ascertain the amount of this $\pm$ pressure.

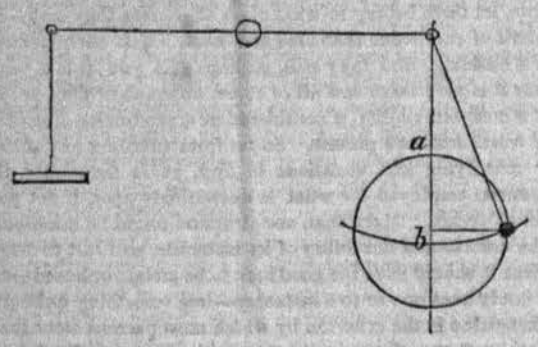
If the square of the velocity of any mass of matter increases in an elementary space n times as much as it would increase by falling through that space,—then the force for that point or elementary space must be n times the force of gravity, or n times the weight of the mass; that is, putting v = the velocity due to falling a given space, and V = the actual velocity,

$$\text{as } dV^2 : dv^2, \text{ or as } V\,dV : v\,dv :: n : 1, \text{ or } \frac{V\,dV}{v\,dv} = n;$$

$$\text{but } v^2 = 2gs, \text{ and differentiating } v\,dv = g\,ds,$$

$$\therefore \frac{V\,dV}{g\,ds} = n, \text{ and for the destruction of motion } \frac{-V\,dV}{-g\,ds} = n.$$

Let z = the angle passed through by the crank;
r = the length of the crank;
s = the space travelled by the piston;
V = the velocity of the piston = $\frac{ds}{dt}$;
v = the velocity of the crank-pin in the arc z = $\frac{r\,dz}{dt}$;
C = the length of the connecting-rod;
c = $\frac{C}{r}$, or the value of C in terms of the length of the crank;
n = the force of inertia or insita in terms of the weight;
P = the pressure on the crank-pin caused by the insita or inertia, or the value of n reduced to the mechanical conditions.



The space described by the piston is = ab;

$$\therefore s = r\left(\text{ver } z + c - (c^2 - \sin^2 z)^{\frac{1}{2}}\right);$$

$$\text{differentiating } \frac{ds}{dt} = \frac{r\,dz}{dt} \times \left(\sin z + \frac{\sin z \cos z}{(c^2 - \sin^2 z)^{\frac{1}{2}}}\right),$$

$$\text{therefore, } V = v \sin z + \frac{v \sin z \cos z}{(c^2 - \sin^2 z)^{\frac{1}{2}}}; \text{ and differentiating}$$

$$dV = v \cos z\,dz + v\left(\frac{\frac{1}{2}\sin^2 2z + \cos 2z\,(c^2 - \sin^2 z)}{(c^2 - \sin^2 z)^{\frac{3}{2}}}\right)dz.$$

The theorem $\frac{V\,dV}{g\,ds} = n$, may be put in a more convenient form, for $\frac{V}{ds} = dt$, and $\frac{v}{r\,dz} = dt$; therefore, $\frac{V}{ds} = \frac{v}{r\,dz}$; and, by substituting, we have $\frac{v\,dV}{g\,r\,dz} = n$.

The motion of the piston-rod and appendages is vertical; therefore, n must be resolved into the direction of the length of the connecting-rod. By the mechanical theorem sometimes called the triangle of forces, we have

$$\frac{n\,c}{(c^2 - \sin^2 z)^{\frac{1}{2}}} = P; \text{ or } \frac{c\,v\,dV}{(c^2 - \sin^2 z)^{\frac{1}{2}}\,g\,r\,dz} = P; \text{ consequently,}$$

$$P = \frac{c\,v^2 \cos z}{32\,r\,(c^2 - \sin^2 z)^{\frac{1}{2}}} + c\,v^2 \cdot \frac{\frac{1}{2}\sin^2 2z + \cos 2z\,(c^2 - \sin^2 z)}{32\,r\,(c^2 - \sin^2 z)^2},$$

the weight being considered unity.

For the beam, let ϱ be a fraction expressing the distance of the centre of gyration from the centre gudgeon when the length of the radius of the beam is 1. Let n' represent the force of inertia of the beam at the point ϱ: then

$$\frac{\varrho\,v\,\varrho\,dV}{g\,\varrho\,r\,dz} = \frac{\varrho\,v\,dV}{g\,r\,dz} = n';$$

but of this force, a portion = $(1-\varrho)\,n'$ will be sustained by the centre gudgeon; the remainder, or $\varrho\,n'$, will be sustained by the top of the connecting-rod, which, multiplied by $\frac{c}{(c^2 - \sin^2 z)^{\frac{1}{2}}}$, gives the pressure on the crank-pin due to the inertia of the beam, which we will call P′; therefore

$$P' = \frac{\varrho^2 c\,v\,dV}{(c^2 - \sin^2 z)^{\frac{1}{2}}\,g\,r\,dz}, \text{ or } P' = \varrho^2 P, \text{ on the supposition that the}$$

end of the beam describes a straight line instead of an arc, which supposition has been made by all writers on the theory of the crank.

The connecting-rod has a compound motion—namely, vertical at the top (neglecting the arc), and circular at the bottom: these two motions may be resolved into vertical and horizontal. The sum of the inertia in the vertical and horizontal directions, resolved in the direction of the length of the rod, will give the value of P″. Let the centre of inertia, in the vertical sense, be supposed to be concentrated in an undetermined point p; this point, when the upper end is moving vertically with greater velocity than the lower end, will be between the top and the centre of gravity; and when the lower end is moving vertically with greater velocity than the upper end, it will be between the bottom and the centre of gravity—practically, it may be considered to be in the centre of gravity.

The upper end will have passed the space s, and the lower end the vertical space r ver z, the point p will have passed a vertical space s', and

$$s' = s - p\,(s - \text{ver } z) = (1-p)\,s + p\,r \text{ ver } z,$$

when p is a fraction expressing the distance of the aforesaid point from the top, the length of the connecting-rod being unity; inserting the value of s, and differentiating

$$ds' = r \sin z\,dz + \frac{(1-p)\sin z \cos z}{(c^2 - \sin^2 z)^{\frac{1}{2}}}\,dz,$$

and the vertical velocity of the point p will be

$$V' = \frac{ds'}{dt} = \frac{r\,dz}{dt} \times \left(\sin z + \frac{(1-p)\sin z \cos z}{(c^2 - \sin^2 z)^{\frac{1}{2}}}\right).$$

Substituting v for $\frac{r\,dz}{dt}$, differentiating and reducing by the "triangle of forces," we have

$$P_v = \frac{c\,v\,dV'}{(c^2 - \sin^2 z)^{\frac{1}{2}}\,g\,r\,dz} = \frac{c\,v^2 \cos z}{32\,r\,(c^2 - \sin^2 z)^{\frac{1}{2}}} + c\,v^2\,(1-p) \cdot \frac{\frac{1}{2}\sin^2 2z + \cos 2z\,(c^2 - \sin^2 z)}{32\,r\,(c^2 - \sin^2 z)^2},$$

which needs no further reduction, inasmuch as there is no vertical support to the top end of the connecting-rod; consequently, the whole of the inertia or insita concentrated in the point p is sustained by the crank-pin.

For the horizontal motion of the connecting-rod, the inertia is concentrated in the centre of gyration, and the space described horizontally by that point will be $\varrho\,r \sin z$: differentiating and substituting, we have

$$V'' = \varrho\,v \cos z; \text{ and ultimately we obtain}$$

$$\frac{v\,dV''}{g\,r\,dz} = -\frac{v^2\,\varrho \sin z}{32\,r} = n'';$$

which will need reducing, because $(1-\varrho)\,n''$ will be supported by the end of the beam laterally; the remainder, $\varrho\,n''$, reduced into the direction of the length of the connecting-rod, by multiplying by $\frac{\sin z}{c}$ gives

$$-\frac{(\varrho\,v \sin z)^2}{32\,r\,c} = P_h; \text{ therefore, for the connecting-rod we have } P_v + P_h =$$

$$\frac{c\,v^2 \cos z}{32\,r\,(c^2 - \sin^2 z)^{\frac{1}{2}}} + c\,v^2(1-p) \cdot \frac{\frac{1}{2}\sin^2 2z + \cos 2z\,(c^2 - \sin^2 z)}{32\,r\,(c^2 - \sin^2 z)^2} - \frac{(\varrho\,v \sin z)^2}{32\,r\,c}$$

Let W = the weight of the piston and rod and appendages; W′ that of the beam; and W″ that of the connecting-rod;—then collecting the above results, we have

$$\pm P = \left(W + \varrho^2 W' + W''\right) \times \frac{c\,v^2 \cos z}{32\,r\,(c^2 - \sin^2 z)^{\frac{1}{2}}} + \left(W + \varrho^2 W' + (1-p)W''\right) \times c\,v^2 \frac{\frac{1}{2}\sin^2 2z + \cos 2z\,(c^2 - \sin^2 z)}{32\,r\,(c^2 - \sin^2 z)^2} - \frac{W''\,(\varrho\,v \sin z)^2}{32\,r\,c}.$$

In the next month's *Journal*, I intend to give a table of the value of P for different angles of the crank, when W = 1, v = 1, r = 1, and c = 4, which will be about a medium value of c. This will reduce the above to the following form: —

$$P = (W + g^2 W' + W'') \times \frac{T v^2}{r}$$, T being the tabular number.

The practical inferences will also be attempted to be shown.

Rochdale, Nov. 15, 1847. M. N.

CANDIDUS'S NOTE-BOOK.

FASCICULUS LXXVI.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. It is an ill wind indeed that blows nobody good. Penny-a-liners thrive upon accidents, "awful occurrences," and disasters: a famine helps to keep them from starvation, and "a most tragical murder" from cutting their own throats. In like manner, the "Arch and Statue" was a windfall to the critics—especially the small-fry gentry, who having got their cue, roared out as lustily as sucking doves. To that enormity, however, we seem to be now reconciled,—perhaps, by the irresistible argument advanced for suffering the Statue to remain, although the reason assigned was such as to cause some people to quote Johnson, and exclaim—

"From Marlborough's eyes the tears of dotage flow."

It is now the Palace which is the general butt of criticism, or rather is beginning to become so; for although it has been censured severely, censure is not as yet so universally expressed,—many preferring, for reasons tolerably obvious, to be silent, and take no notice of it at all. Their very silence, however, is most significantly condemnatory of the Palace, since they would be fulsomely loud with their praise, were it possible in any way to commend it. Their silence, moreover, betrays what sort of solicitude it is with which they so busily interest themselves, and affect to watch over the interests of Art. Criticism—honest and genuine criticism—is no respecter of persons: it makes no distinction between Prince or Pecksniff; or if it made distinction at all, it would be to animadvert with most severity on bad taste and paltriness of taste in the former, as being decidedly influential for mischief to Art.

II. One presumption strongly in favour of those who betake themselves to the practice of any art to which they were not at first educated in their youth, is that they have been impelled to do so by a natural irresistible impulse towards it and a sincere affection for it. Accordingly, when Mr. Blore abandoned his original profession of engraver for that of architect, there was reasonable ground for supposing he was instigated to do so by the consciousness of possessing not only a preference, but superior talent for the art which he thought proper to make his new calling. It was not, indeed, to be supposed that he would distinguish himself by any particular ability in construction and other mechanical and technical matters, or in what comes under the general term of business, yet it was rather to be expected that he would display some touches at least of genius and imagination—some of those felicitous unborrowed ideas that not all the professional training in the world will enable any one to produce. Nevertheless, it is precisely in the artistic and imaginative that Blore fails, and fails most egregiously; wherefore he may, so far, be said to signalize himself egregiously also. Reversing what the satirist says of Perrault, he has turned from a good draughtsman and engraver, a wretchedly bad architect. Fondness for architecture he may have; although even that may be questioned, since *con amore* feeling never impels him to exhibit at the Royal Academy,—a piece of forbearance in which he emulates another shining glory of the British school of architecture. He will not, it may be presumed, break through his rule of non-exhibiting, even out of compliment to the Palace, and yet he might take the opportunity of showing his "new building" to very great advantage in a drawing, by representing it just as it shows itself through a very dense fog.

III. An article in the *New Monthly*, purporting to be a "Secret History of the Court and Times of George IV.," contains the following interesting contribution to architectural history. "During the time the unhappy man [Cashman, the sailor,] was suffering the sentence of the law, the Prince [Regent] was occupied in the inspection of a surveyor's [!] estimate and plans for the erection of a house for the Duke of Wellington. 'A palace it shall be,' exclaimed his royal highness. Lord Burghursh detailed to the Prince all its *proportions*, it occupying four fronts. The architect of this design is young Cockerell, and his estimate five hundred thousand pounds, every farthing of which, the Prince says, shall be expended upon it. How the money is to be raised is another question." It is still a question perhaps if this same piquant anecdote be little better than one of those random bits of gossip which the concoctors of "secret histories" so greedily swallow and so complacently divulge. At any rate, "young Cockerell" must know something of the matter, yet he seems disposed to keep the secret, notwithstanding that a design which would have required half-a-million to execute must have been something *magnifique*,—the mere fame of which ought to have overwhelmed the author of it with commissions. It did not however, help him to the patronage of George himself, for when Buckingham House was to be metamorphosed into Buckingham Palace, he gave the job to Nash. While as to the Duke, he, perhaps, finding that the intention of building him 'a palace' had clean evaporated, bethought of building for himself a snug little house, for which he employed Ben Wyatt as his Vitruvius, and which, if not an architectural "lion," deserves very well to pass for an architectural sheep.

IV. Another bit is at any rate curious, as showing after what fashion the writer understood what he was speaking of.—"*New Improvements!* Waterloo Place, opposite Carlton House, is beginning to assume something like an uniform feature with (the) façade of Carlton House. The columns are composed of brick supporting a scaffolding pole (!), and the latter supports the entablature (!). Now, when the pole rots, down will come the whole structure. So much for the economy of the architect." And so much, also, for the *nous* of the critic who discerned scaffolding poles supported by the columns, and supporting the entablature.

V. Without corresponding worthiness of design, value and goodness of material only increases dissatisfaction—that is, of the intelligent; for the uneducated in art—and who are so far the vulgar, the uninitiated *profanum vulgus*, let them belong to what class of society they may—have no other standard of excellence than size and cost. Ask such persons their opinion of a building, and they will perhaps tell you it is a very grand one, because it is very large and all of stone, although it may nevertheless be in itself a complete nullity, if considered as a production of architecture, and hardly worth lath and plaster. So far from affording any satisfaction, it is truly mortifying and vexatious to find, as is frequently the case, superior material employed for what is exceedingly poor, if not positively bad in point of design. More than one structure might be mentioned that, owing to the unfortunate durability of its materials, will last to disgrace its author, unless it should have the good luck to be metamorphosed—of which there have lately been one or two instances—into something quite different. Mere market-value is the criterion by which most persons steer their criticism. Tell them that a picture cost a thousand guineas, and—O, the hypocrites!—they will instantly pretend to admire it—to discern a thousand beauties in it, although, in all probability, they had actually turned up their noses at the very same performance had they heard that it cost only two pounds, or that it was painted by some *Mr. Smith*. Almost the very first question or remark of all which people ask concerning what ought to be estimated by its artistic value, relates to cost and price,—which is both exceedingly vulgar, and exceedingly English. It is the ordinary reverence for mere cost and sumptuousness that has obtained so much fame for Versailles, that monument of a taste at once frivolous and prosaic,—poetic only in the wasteful prodigality that stamps it, showing what reckless profusion can do for utter barrenness of imagination, and how exceedingly little the utmost it can accomplish is. All that the most extravagant expenditure of money could effect was there done. Of money-power there was vastly more than enough to have produced the most glorious monument of architecture the world ever beheld, or fancy can conceive, if there be any foundation for the almost fabulous statements that have been put forth relative to its cost, some of which give a total of *Five Hundred*, others of *Twelve Hundred*, *Millions* of francs! Of art-power, however, there was none; nevertheless great influence for perverting taste throughout all Europe.

VI. Those who are so excessively rigid in their notions as to tolerate no imitative materials for decoration, but would proscribe them altogether as "sham," and of course very paltry also, no matter how artistically they may be employed, and how excellent the effect produced,—such persons, I say, must feel quite scandalised at Sir Walter Scott's taste in carrying

"sham" to the *outré* excess which he sometimes did. Verily the great novelist's love of fiction must have been quite overrunning, when he directed Mr. Hay to paint him sham frames to pictures—a species of deception so inartistic—or rather a mere attempt at deception, which instantly betrays itself to the eye, that almost any one would, on seeing it, exclaim with Macbeth: "Unreal mockery, hence!" Lest I myself should be fancied to be here romancing, by imputing the strange freak in question to Sir Walter, I will quote Mr. Hay's own words concerning it. After saying that Scott had directed him where to fix up four pictures,—two *small* ones (one of them a view of Melrose Abbey by moonlight) being to be placed *over* doors,—a most unfit situation for paintings of small dimensions,—he proceeds to state that: "these, after being fixed to the wall by a narrow moulding of oak, were to be surrounded with an imitation of a carved frame of the same material, *painted in light and shade upon the flat plaster*." Now, however ably executed—with how admirable so ever bravura of relief the appearance of actual carving projecting from the wall might be rendered, the eye could not fail to detect the deception upon almost the very first change of position; and if they happened to be viewed sideways, it would at once be perceived that those frames were only flat painted *borders*, without any projection at all, while the real "narrow moulding of oak" would by its projection on the wall show itself very awkwardly. Such a mixture of the imitative and the real must have been in very bad and puerile taste—both excusable and to be accounted for only as a mere whim on the part of Sir Walter, for the fun of "taking in" his guests after that fashion, making them stare, and enjoying their surprise. Painted frames to detached pictures hung upon a wall are just as preposterous as real picture frames of the usual kind would be for paintings executed upon the walls, instead of either architectural mouldings around them, or else painted borders. Decorative painting should never be permitted to aim at more than mere *pattern* in colours—not at relief or the imitation of actual carving. Painted mouldings or other architectural members—and instances there have been of painted niches and statues—are in vile taste, because the deception so produced can be only momentary, the artifice, if such it can be called, being detected after the first glance, and proclaiming that the decoration so aimed at could not be afforded. With imitative material the case is altogether and widely different: the resemblance may be so perfect that the most experienced eye may not be able to detect it, and provided it shows just the same to the eye, it produces an effect fully equal to what the real material would do. Every one knows, for instance, that gilded ornaments are not of the solid metal, but merely covered with leaf gold of almost incredible thinness—the two hundred and eighty-thousandth of an inch!—what then? the appearance is produced, and it is with appearance, and appearance only, that embellishment has to concern itself. I, for one, am unable to sympathize with those who affect to be shocked at the ingenious imitations and deceptions of art, reprobating them as if they were downright frauds and offences against common honesty. Were any one to sell, or rather attempt to sell, a plaster cast made to imitate marble, for a real piece of sculpture of that material, he would, no doubt, be himself a genuine knave; but there is no moral imposition in placing such casts on the top of bookcases, or in other situations where they may pass for being of marble, which last material would produce only just the same effect.—"What matters it to you or me," I once heard a person say to another, speaking of a lady, "whether she rouges or not. Granting that the bloom of her complexion may be artificial—and you only suspect it,—I take the beauty of it to be just the same as if it was real: a difference of course there is; but that is her affair, therefore a truce with your preaching."—Value of material adds nothing to the merit of design—of the architect's own share in the work, who, if he be an artist, will display talent and produce effect with the homeliest and cheapest materials,—with merely fictitious ones—alias "sham;" while he who is not, will show the very best materials to disadvantage, and render them less valuable than they were before being used, or we may say abused, by being applied to humdrum designs.

VII. Hay has had a hit at Sang's decorations in the Royal Exchange, which he has the delicacy, however, not to mention by name, contenting himself with alluding to it so very pointedly that no one can possibly mistake. "Our general knowledge," he observes, "even of the propriety necessary to be observed in decorations, is so far below the requisite standard that the grossest absurdities are often committed. For instance, we find the most flimsy and fantastical style of ornamental design, borrowed at third or fourth hand from a building devoted to the private luxury of an ancient Roman, adopted as a suitable style for the interior of an arcade remarkable for its plain and substantial massiveness, and devoted to a species of public business of such a grave nature, &c., &c."—"It is scarcely possible," he continues, "to conceive a greater degree of decorative incongruity than this, yet it has been committed in one of our greatest national edifices, amidst all the agitation that exists in regard to national advancement in the art of ornamental design." The censure is perfectly just: the mistake there committed is such an obvious and palpable one, that it is extraordinary it should have been allowed to be perpetrated. Were it possible to entertain so strange a suspicion, we might imagine that this specimen was intended to satisfy the public most effectually one way, namely, by cloying them and sickening them at once, and so preventing all further outcry for similar embellishment in our public buildings.—As to "the agitation that exists in regard to national advancement, &c.," there is a good deal of humbug in it—far more of cant than of sincerity of purpose; or if there be the sincerity, the knowledge which should accompany it is wanting. Lord Morpeth—or if it was not Morpeth, it was Lord Somebody-else—is reported to have said in the House, he thought the public would be satisfied with Buckingham Palace—the unlucky Palace again! but it can't be helped—after Mr. Blore's alterations—his lordship was too conscientious to make use of the word "improvements." But what a mean opinion then must he entertain of the public taste, and how very little regard must he have for its "advancement,"—that is, supposing him not to be himself an utter novice in matters of art, and to have had no suspicion of what a balaam design he was recommending to the "House," *pro bono publico*; a design which now makes the Palace look almost twin-brother to the Barracks just by, in the Birdcage Walk, with which Blore or somebody else must have been so smitten, as to take the leading idea from it.—Verily, it was not without reason that some one lately quoted, or pretended to quote, the following distich:

"Unhappy Britain! doomed to be disgraced
By Pecksniff palaces, and Royal taste!"

VIII. Errors of the press are, if generally provoking, sometimes exceedingly diverting, as, for instance, that of a certain "print" which has transformed the "Army and Navy Clubhouse" into that of the "Armoury and Knavery," than which Mrs. Malaprop herself never uttered so amusing a blunder. That there has been any sort of knavery in the matter, we are bound not to suspect; nevertheless, there is much which looks like manœuvering. Most assuredly it looks like any thing but fair play on the part of the Club to enlarge their site after the first competition, without allowing the first competitors—those who had tasked their ingenuity to provide the required accommodation within a space which the Club themselves have since virtually declared to have been insufficient—to take their chance in a second competition. Well, the refusal may have been mercy, although, apparently, it does not say much for the liberality of the "Armoury and Knavery." And what have they got after all by their clever scheming?—why, a piracy from Sansovino for their exterior, and for their interior, a most humdrum, namby-pamby plan, devoid of all invention, contrivance, and study of effect—merits which the "Armoury and Knavery" people have perhaps no conception, much less any appreciation of. For Clubhouses at least, if not for private houses, it might be supposed that something more than mere routine plan would begin to be thought of, for in that direction, if no other, there is room for advance, and great scope for improvement. Admitting that compound forms of rooms are more expensive than the usual four-sided ones, and that they also occasion some loss of space, consequently are out of the question for houses in general where economy as to both cost and space must be chiefly attended to, so far from being an argument against, it is a *raison de plus* for such forms and picturesque effects being purposely introduced in Clubhouses and other houses of a superior grade, instead of four walls with a flat ceiling, and perhaps a cove to it, being, as the *Athenæum* remarks, all the elements out of which their apartments are constituted. Surely, says the writer in that journal, if it be worth while to expend so much as is sometimes done upon superficial and accessory embellishment, it would be equally so to endeavour to secure in the first instance impressive architectural physiognomy, the charm of which is more lasting than the gratification afforded by mere ornamental detail. It is, indeed, greatly to be lamented that neither architects nor their employers perceive—or even if they do perceive, care to turn to account the infinite resources for both design and effect which present themselves as soon as we break away from the wearisome monotony of plan, disposition, and forms in the interiors of houses, which now prevails, to the exclusion of all individual character except that which arises from ornamentation alone.

IX. So very little study is given to matters of plan in rooms, either as regards *ensemble* or individual parts and detail, that the eye is frequently

offended by the most unpardonable negligence, and sometimes by the most arrant bungling, in point of design, even in large and expensively fitted-up and furnished apartments, where, just in order to save a little exertion of ingenuity and contrivance, symmetry and balance have been more or less disregarded. Thus that consideration of the subject and actual circumstances, which would almost of necessity prompt fresh ideas expressly adapted to the occasion, is altogether evaded, and the merest ordinary routine is substituted for artistic composition and artistic effect. In fact, the majority of those who call themselves architects, appear to have not so much as any conception of what artistic effect is,—not even so much as to suspect that it can have anything to do with their own art. The truth—and a sad truth it is, architects are not educated artistically: artists they may eventually become, but it must be entirely by the promptings of their own mind, for by others they are not even so much as put into the way of becoming such—which is the utmost that can be done by the very best artistic education. Well, therefore, was it said by one who valued his art, on being asked to take a lad as his articled apprentice: "I can engage to make your son a good practical builder, but as for architect, you might as well ask me to make him an archbishop!"—To dismiss remarks of this kind, I return to what occasioned them, by affirming that effect—genuine artistic effect—is generally the very last thing of all that is thought of in planning interiors. It will, no doubt, be urged very sapiently that effect adds nothing to convenience. Most assuredly not; but so neither does embellishment, which is only for the sake of that species and degree of effect—certainly not the most valuable of all, that is to be so obtained; it being, on the contrary, that which is most easily of all ensured. Consequently, if effect be not worth the study required for producing it, so neither is decoration worth its cost, and the latter may be, by very far, the more costly of the two, because the other may sometimes be produced by the simplest means, without other expenditure than that of artistic skill.

X. The name of Nash, of very questionable fame in John the architect, is now honoured by the talent of Joseph the artist, whose mastery of power in the representation of architectural subjects, more particularly interiors, with all their manifold accessories, surpasses all praise. Those of Windsor Castle by him form a matchless series of architectural pictures, and completely refute the opinion—if such opinion requires other refutation than its own absurdity and evident prejudice—that subjects of the kind, that is, mere rooms and their furniture, cannot be rendered picturesque—at least, not if represented in all their freshness and beauty, and in perfect order, without any of those accidents and disarrangements which are generally considered indispensably essential to the picturesque. Although it may not answer to the usual notion of the picturesque, almost anything may be rendered picturesque, or in other words, highly pictorial in representation, by being treated picturesquely, and in an artist-like manner. Even what is insipid in itself, and viewed with perfect indifference, may be rescued from insipidity, and invested with attractiveness, by the power and skill of the pencil,—as in the case, for instance, with paintings of still-life, which are frequently composed of the most trivial objects—such as would in their reality not be looked at at all. Surely then, what is beautiful, pleasing, and interesting in reality, must, if faithfully pourtrayed, be equally beautiful and pleasing in representation, and possess besides, the additional charm imparted to it by the artist; that is, supposing the latter to have seized upon and brought out all the piquant points and qualities of his subject. Architectural scenes of the kind in question possess this strong recommendation—or what ought to be such—that, besides being works of art themselves, they may be rendered the vehicle for exhibiting other works of art—paintings, sculpture, statues, carvings, mosaics, tapestry, &c., almost any one of which would be an excellent still-life subject. Such scenes are therefore fully worthy of the utmost finish of execution: in them truth of imitation cannot possibly be carried too far, whereas highly elaborate execution seems quite thrown away when bestowed, as it often is, upon the facsimile imitation of what may be seen at any time, and is so trivial that when seen it is not noticed.—Nash's pictures—for they are infinitely more than *drawings*, possess a truthfulness of local colour, perspective, and chiaroscuro, with a captivating effect of general composition, that places them in a very high rank of art—at least would secure for them such rank, were it not for the pedantical and nonsensical etiquette that now regulates precedency in art. Art is not to be measured and valued by the acre. Yet the veriest namby-pamby when magnified to the dimensions of a cartoon passes for "high art." Some very strong instances of the idealess and powerless, marked by outrageously bad drawing, are afforded by the cartoons selected for the recently published "Art-Union," outline prints. If, however, those productions do not tend to enlighten public taste, they serve to illustrate something, since very well might they be called Illustrations of Humbug.

VENICE; AND HER ARTS.

By Frederick Lush.

(*Continued from page* 345.)

Pococke, in his "Description of the East," after giving an account of a magnificent mosque, called Kubbe-el-Azab, or the cupola of the Azabs, in Grand Cairo, states, that there was one particular apartment more sumptuous than the rest, which was built by a grand vizier, who desired the sultan to give him leave to prepare a place fit to offer him a sherbet in, on his return from Mecca. There is every probability that a similar feeling was entertained by the Venetians towards the grandees and merchant-princes of Cairo, Damascus, and other sister cities, between whom a very active commerce and intercourse was carried on;—but whether such a feeling existed or not, it is certain that the same Arabic idea and spirit of building prevailed in Venice, and prompted the early builders; and the palaces, in which the Saracenic predominates, seem to have been cotemporary with, and partly constructed in imitation of, the mosques of the sultans of Cairo. There was not—and there is not at the present day—throughout all Italy a spot more in accordance with the tastes, or better accommodated to the habits, of the orientalist, than the old *Piazza di San Marco*, before it was destroyed by fire, when it bore a close resemblance to the court of a mosque—as shown in the large and curious picture by Gentile Bellini (A.D. 1496), exhibited in the *Accademia*. The inspection of this production—which preserves, as in a rich cabinet, the ornaments, the "barbaric pearl and gold," and costume of the period, and in which is so closely imitated the curiously carved candelabra, crucifixes, and reliques borne by the procession in their celebration of the festival which it represents—enables us to form a pretty correct idea of what must have been its original appearance. Then ambassadors and other personages from foreign countries, sojourning in Venice for the transaction of commercial affairs, or for the mere purpose of witnessing her civic or ecclesiastical ceremonies, must have admitted its splendour, and been gratified with its many gorgeous spectacles. Then it was entirely Saracenic; the collonnades were Arabic, with horse-shoe archivolts; its cornices serrated, the details of the oriental style imitated, and its pavement chequered with bright red and white marble.* The adjoining Piazzetta, in itself, in its features, and in the views it embraced, was, and even now is, equally oriental. Here, the Ducal palace, one of the most beautiful edifices in the world, rears itself,—and there could not, perhaps, be a finer and more appropriate site selected for it. It is set off to the greatest advantage upon its marble terrace or *jettée*, stretching into the lagoon: the picturesque groups of Armenians, Turks, gondoliers, and water-carriers, scattered upon that terrace, and the lagoon variegrated with many a goudola, painted sail, and fruit-laden vessel, being in admirable keeping with its Eastern appearance. "It was constructed by Calendario, in the middle of the 14th century, and seems to have been a contemporary of the mosque of Sultan Hassan in Cairo, just after the two great Kalaons had added so many magnificent edifices to that capital." In its façades, we cannot but admire the principles studied by the architect in the details, which tell with considerable effect in themselves, and at the same time contribute, in a great measure, to the grandeur of the whole; the harmonizing contrast and relief which the curious and elaborate tracery forms to the more simple parts; the opposition of light and shade which are observable throughout; and the difficulty there is, if not the absurdity, of inventing and applying, in the place of those features which now exist, others more appropriate and expressive. It was a common practice among the Arabs, to give also the effect of colour and lightness to buildings which possessed a great measure of solidity, by means of slabs of red and white or green porphyry, and other valuable marbles, arranged in diamond patterns on the external surface of the walls, and sometimes the covering of their domes,—a method of inlaying followed by the Venetians, of which a beautiful example is seen in the broad masses of the Ducal palace, between the windows; an introduction the most happy and the most

* Some of the above remarks are suggested by the reading of an interesting paper in the "Athenæum" of Sept. 25, 1847, called "Arab Gleanings in Venice."

artistic, since it tends to prevent an appearance of heaviness and excess of weight, which might, but for this precaution, result from those masses being above a light corridor and perforated gallery. We see this beautiful feature made as an accessory by Titian to his splendid picture of the "Presentation of the Virgin." And this ancient combination of bright red with polished white marble, seen in almost every mosque of Cairo at the present day, and which so frequently occurs in Venetian pavements, was likewise imitated throughout great portions of Italy, &c., during the middle ages; and inscriptions on the walls, grotesque carvings, heraldic ornaments, and curious devices, having some peculiar reference to the inventor or proprietor, which obtained among the moderns, may be traced back to a very remote period, and were considered an almost indispensable decoration of ancient Arabian, Chinese, Persian, and Hindu architecture. A writer states, that "in the friezes between the floors [of the Square of St. Mark] we see what at first sight appears to be the *Sulus*, or large Arabic 'writing on the wall' of mosques; but as they could not, in a Christian country, write sentences from the Koran, we find, on looking closer, that the characters are figures of white camelopards (giraffes) on a red ground. These carry the mind to the East by more associations than one; for their long legs and tapering necks have quite the air of *Sulus* writing."

"The original Merceria," remarks the same writer,* "with its pendant shutters, narrow crowded thoroughfares, and the wares of brilliant colour in its dark, limpid shades, must have had very much the air of a bazaar—which it has not lost even now. Cantar, rottalo, and other Venetian weights, are still the standards of quantity in the Levant; and in the name of Campo, applied to all the khans of Aleppo, we find a Venetian expression. There were several places in Venice in the form of a khan; one of which—the Campo St. Angelo—is still remaining. The principal one—the Campo dei Mori, or Khan of the Moors, at Madonna del Orto—has been taken down; but I still observed the stone figure of a Bedouin loading a camel, in alto-relievo on the wall next the canal.

"Several remarkable edifices of Saracenic architecture are yet visible on the Grand canal:—one of which is the Fondaco dei Turchi. There is, however, no connexion between its architecture and the subsequent destination which gave it its name. It is supposed to have been built in the 12th or 13th century, when the Saracenic taste was in full prevalence: and extracts from documents which were shown to me by Count Agostino Sagredo, the present accomplished president of the Academy of Fine Arts, show that it was given by the republic to the Duke of Ferrara,—after him passed through several hands to the Pesaro family,—and in 1621 was let by them to the Turks. It is now in course of restoration and repair by the commune. The Palazzo Loredano, a peculiarly light and handsome specimen of Saracenic architecture, built since the invasion of the Italian style—and the celebrated Ca d'Oro, now the property of Taglioni—are both so well known as to require no further consideration.

"No painters caught the oriental costume nearly so well as the Venetians; who, though ambassadors, merchants, and slaves, had frequent opportunities of becoming acquainted with it. The oriental air and manner are better seized in Tintoretto's great picture of 'the Miracle of St. Mark,' or 'a Slave liberated from Bondage,' than in any picture that I have ever seen. The kaoucks were universally worn in the East in Tintoretto's time (and so very nearly in our own age); but, with this exception, the figures might now be alive in Cairo and Damascus, without any one discovering any great peculiarity. Traces of the connexion with the East are constantly appearing in the Venetian pictures. In Giovanni Mansueti's pictures we see *segredies* hung out of the windows; the scarf of Titian's Maddalena is evidently of Tripoli manufacture; and the 'Supper in the House of Levi'—where Paul Veronese is enthroned in all the dazzling splendour and gorgeous magnificence of his genius—has for its principal figure green velvet hose, of a most curious arabesque pattern."

Having pointed out some of the most important relics of Saracenial and Arabic architecture and ornament in Venice, as showing her connexion with the East, we shall now briefly describe its principal characteristics.

The genius of the Arabians and Saracens abounded in liveliness of fancy and in richness of invention, which manifested itself alike in their pursuits and in their poetry,—in their learning and in their arts; in all of which they rendered themselves remarkable. They equally distinguished themselves by their warlike achievements; and the briskness and activity of their temperament (whether the effect of the warmth of their climate, temperance, and constant exercise), joined to their enthusiasm, constantly stimulated them to great exertions and extraordinary actions. Their love of learning and the arts was cultivated throughout the whole of their dominions, and was diffused abroad, being first carried into Africa (where they erected a great many universities), and from thence into Spain and other countries; whilst they conquered Syria, Persia, Egypt, &c., and established themselves upon the ruins of the Grecian empire.* Such a city as Venice, and such a people as the Venetians, was much enriched, therefore, by its intercourse and dealings with the polished Saracens. The style of their architecture is generally regarded as the immediate precursor of the Gothic. To the Gothic (if we may use the term) of some countries it is more closely allied than that of others; and just as the character of the Gothic varied in different localities and countries, according to the Roman and other styles with which it was brought in contact, and with which it was sometimes amalgamated, so we may observe the Saracenic was more or less pure, and underwent different changes as it was translated into different countries. "The Saracens, in their buildings in Egypt, appear to have availed themselves in a small degree only, of the style of the aboriginal inhabitants, and are distinguished by the lofty boldness of their vaultings, the slenderness of columns, the variety of capitals, and the immense profusion of ornaments. The greatest peculiarity, however, lies in the small clustered pillars of pointed arches, formed by the segments of two intersecting circles. The Egyptian Saracenic varies from the Spanish chiefly in the form of the arch, as will be apparent from comparing the gate of Cairo with that of the Alhambra in Grenada, or the great church at Cordova."

As examples of Saracenic decoration in Venice, including among them the Byzantine, we refer more especially to St. Mark's and the adjoining palace; where, notwithstanding the intermixture of these and other styles, we may discern the distinctive features of each:—1st. The blending of the pointed arch, ornate filial, and crocket-work of the Gothic, with the horse-shoe scrolls and richly multiplied geometrical patterns of the Moorish ornaments; forming what the Italians call the Arabo-Tedesco. 2nd. In the façade of St. Mark: the clustering domes and minarets; the tabernacles terminating in pointed pinnacles; and the circular gables, fringed with a most beautiful arabesque foliage. 3rd. The turned wooden grates over the great gates, and the ornamental fans to the windows, of the very patterns used to this day in Cairo—and which, in the 15th century, were all gilt. 4th. In the interior: the twisted columns, of which there are four, two of oriental alabaster—the workmanship imputed to the time of the successors of Constantine; the horse-shoe arches; and the variety of capitals, sculptured with grotesque imagery, where the bell is sometimes covered over with a sort of basket-work of true lovers' knots; and where the scroll, the pineapple, palm-branch, and acanthus-leaf, are placed amongst lions' heads, masks, and half-figures fiddling, &c. Some are beautiful; all are curious; and although the designs might be considered great corruptions and sad departures from the "correct" taste of the Ionic or Corinthian, in the opinion of those who would bring them to the standard of the "five orders,"—yet the invention and originality displayed in some of these capitals must be acknowledged by every unprejudiced observer. In lieu of the volutes in some, pigeons are placed in the angles; in others, rams, with their feet resting on a tier of leaves. The flutes and fillets twisting round the shafts of the columns in a spiral manner, are frequent in the Venetian palaces. Many other Byzantine, Moorish, and Saracenic features in St. Mark's have already been mentioned. 5th. The portal, called *Porta della Carta*, opening into the Cortile of the Doge's palace, facing the Giant's-stairs, the statues and foliage of which we class under the Saracenic, as partaking much of its character, although said to have been the work of Bartolomeo Buono, of the 15th century. Wood, in his "Letters," says of it:—"The arches here, and indeed in all the parts, are very much broken and confused; the architect appearing to have a great horror of a continued line, whether straight or curved." It is to this latter circumstance, we think, that it owes all its singular beauty. 6th. The Cortile itself; the arcades surrounding which, and the character imparted to it by the two elegantly chased bronze reservoirs in the marble areas, reminding us of those splendid courts erected by the Spanish Moors to their Alcozara and Alhambra. 7th. Nearly all the details of the Ducal palace.—But the peculiarities of the examples above enumerated constantly occur in the early edifices of the Venetians.

We will now turn to a new era that dawned upon Venice, and, with the rise of new thoughts, other styles which were introduced in, and which considerably altered the appearance of, the capital; a change, however, which, on many accounts, increased rather than diminished its charm and celebrity. The edifices of the earlier and of the later epochs (the last we

* "Athenæum," Sept. 25.

* Ockley's "History of the Saracens."

shall now consider)—the former we might term EXOTIC—the latter, as more immediately the growth of Italy, NATIONAL—marked and were identified with the two distinct countries in which they originated. The modifications and improvements of which these were susceptible, and the perfection to which the latter was carried, prevented the city savouring of any degree of monotony; and, indeed, it is in the various phases of style and diversity of character in this city of palaces—favoured as it is in this respect by the views, the most tempting to the painter, which a labyrinth of serpentine streets and canals continually present—which appeal with so much interest to the historian, archæologist, and artist; and constitute the great charms of the pictures of Canaletti.

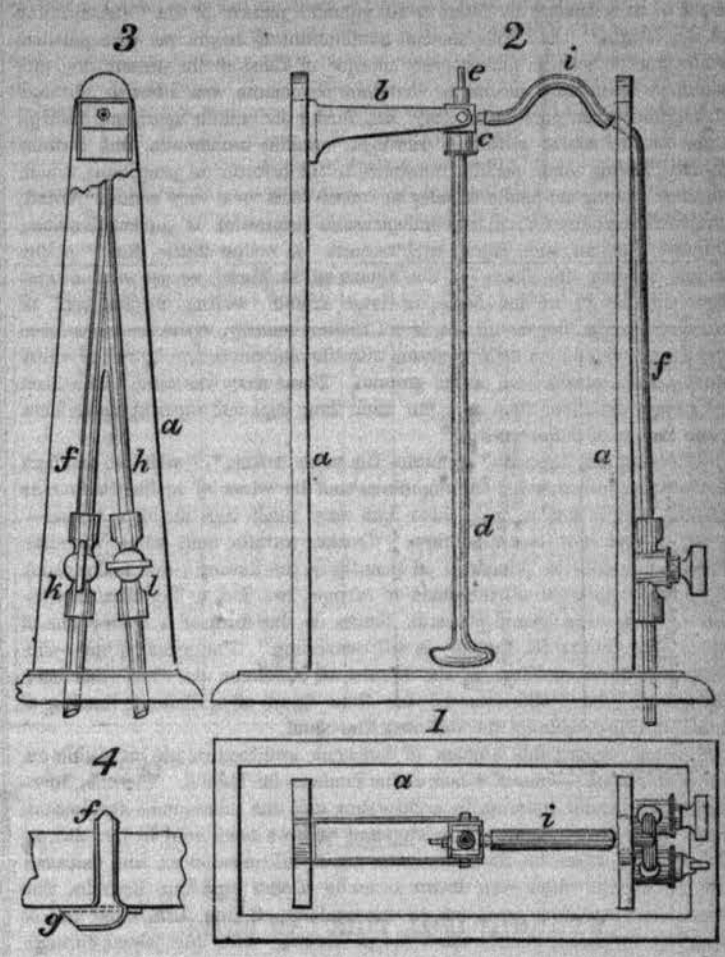
If the Italians exhibited, in their revived architecture, less of the passion for the picturesque than their predecessors, they achieved grander results than had been accomplished by them; if in their works there was less imagination—that is, less of a capricious kind—there was more reason; if less to win upon the feelings of the poet, there was more to satisfy the individual whose views were moulded and shaped by regulation and rule;—but various causes prevent all analogy in the two cases; their beauties and defects are in no way referable to the same standard; and hence it is we entirely demur to that one-sided and partial observation which denies any merit to exist in one style of architecture, because it differs from another: we rather like to enjoy their separate beauties and features; and allow, at least, the existence of fitness, propriety, and every essential of beauty, in all works, however opposite they may be in character, which are in harmony with the tastes and requirements of the nations and times that produced them. But we may remark, in a comparison of the Arabic with the Italian styles, that whereas the former, by the manner of the division and multiplication of the parts, produced a degree of variety that at first seemed almost confusion; in the latter, those parts being less minutely divided, fewer, and larger, simplicity resulted; *before*, it seemed scarcely as if they were under the guidance of any sound canons or fixed principles, where the chief object was to give the freest scope and play to the fancy: but, *now*, the precepts and principles, as derived more immediately from a greater considering intellect and a less indulging imagination, were stern, severe, and settled,—the fancy being reined in—her movements restrained by the cooler dictates of the understanding; yet the influence of a favoured climate shed its elegancy and refinement over the minds of the Italian artists, imbueing them with that poetic feeling which made their works look noble, classic, and stately—and far, very far, from cold or prosaic, though they might not boast of the luxuriant profusion of their predecessors, the Moors and Arabians.

HYDRAULIC LOG.

The common log is a simple apparatus, familiar to all who have been within the view of the encirling horizon; and, were its accuracy equal to its simplicity, it would undoubtedly be a perfect instrument. Such, however, is not the case,—hence various contrivances have been proposed: Massey's patent log, and Cavé's apparatus for indicating the speed of a vessel, are both very ingenious contrivances, but apparently too complicated to answer the purpose intended. The former will answer tolerably well within a limited range of the speed to which the driving-cone is adjusted, but at any considerable variation from that speed its correctness is not to be depended on. Perhaps, it may be said that the common log is sufficient for its purpose, because it has never yet been superseded; true, it has not been superseded, and why?—because nothing has yet been introduced having the two necessary qualities, *simplicity* and *accuracy* combined. I leave the question of the sufficiency of the common log to those who have practical experience on the matter, and who, I am sure, will appreciate an instrument which may at all times be relied upon. And though it matters not much when the errors of the common log can be corrected by observation, yet, when the state of the weather and atmosphere for several days, or weeks, do not admit of observations being taken, it becomes a matter of great importance to know the actual distance the vessel has traversed.

The instrument I propose for this purpose is free from mechanical complexity, depending for its accuracy entirely upon the natural law and hydrodynamic property of fluids, and having some similarity to a common barometer.

A reference to the annexed diagram will explain the construction of the



instrument. The figures are drawn to a scale of two inches to a foot. Fig. 1, is a plan; fig. 2, is a side elevation; fig. 3, is an end elevation; and fig. 4, is a broken section of the pipe *f*, and mouth-piece *g*. *a a*, is a frame or stand; *b*, is a bracket, forming with the piece *c*, a universal joint *d*, is a glass tube having a bulb at its lower end for the purpose of holding mercury and with which it should be rather more than half filled; this tube must be firmly fixed in the piece *c*; *e*, is another glass tube, with a small bore, passing through, and within an eighth of an inch of the bottom of, the former, its upper end being open to the atmosphere, but communication with the latter and the interior of the tube *d*, is prevented by making its passage through the piece *c*, air-tight; *f*, is a pipe, of about half an inch bore, passing through the ship's bottom, as near midships as convenient; *g*, is a mouth piece or cover, having an aperture parallel with the keel; *h*, is another pipe similar to the first, but without the mouth-piece *g*, (or the two pipes may be made in one, like a double barrel gun, in the passage through the ship's bottom); *i*, is an elastic tube of vulcanised india-rubber, completing the connexion of the apparatus.

The instrument being understood, its action will readily be perceived. As the mouth-piece *g*, is turned in a direction with the vessel's motion it is evident that an upward pressure in the tube *f*, will take place in proportion to the velocity of the vessel; and as this upward pressure will be exerted on the top of the mercury, it follows that the latter will rise in the small tube exactly in the same proportion, and will indicate, by means of a gradual scale, the number of miles and any fractional parts thereof into which the scale may be divided. In fixing the apparatus, care must be taken to keep the bulb of the tube *d*, a few inches below the light-draft water-line. Now, when the vessel is deeply immersed, the column of mercury will rise in the small tube to counteract the pressure of the water (about four-fifths of an inch for each foot of immersion), consequently the scale must be made to slide on the tube *d*; the pipe *h*, and cock *l*, are for the purpose of adjusting the scale with the depth of immersion, and is effected thus:—shut the cock *k*, and open the cock *l*, and the mercury will adjust itself to balance the

specific gravity of the water above the mercury in the bulb. Set *o*, of the scale to this point, and open the cock *k*, and shut the other, and the instrument is ready to indicate the speed of the vessel.

I subjoin a table founded upon a series of experiments instituted with a view of ascertaining the resistance on a plane in still water at various velocities, the result of which I have given in a pamphlet, entitled, "Practical Observations on the Steam Engine." This scale, however, must be tested by further experiments to ensure perfect accuracy.

Column 1, represents nautical miles, and column 2 the height of a column of mercury in inches and decimals.

Nautical miles.	Height in inches, and decimals.	Nautical miles.	Height in inches, and decimals.
1·0	0·050	9·0	3·968
1·5	0·110	9·5	4·420
2·0	0·188	10·0	4·898
2·5	0·306	10·5	5·400
3·0	0·440	11·0	6·056
3·5	0·600	11·5	6·478
4·0	0·784	12·0	7·058
4·5	0·992	12·5	7·654
5·0	1·226	13·0	8·212
5·5	1·484	13 5	8·928
6·0	1·764	14·0	9·612
6·5	2·070	14·5	10·302
7·0	2·400	15·0	11·036
7·5	2·754	15·5	11·774
8·0	3·136	16·0	12·556
8·5	3·538		

November, 1847. G. V. Gustafsson.

WROUGHT-IRON TUBULAR BRIDGES.

In consequence of the experiments made at the suggestion of Mr. Robert Stephenson by Mr. Eaton Hodgkinson and Mr. Fairbairn of Manchester, at Millwall, to ascertain the best form of tubular bridge for carrying the Chester and Holyhead railway across the Menai Staits, Mr. Fairbairn has devoted his particular attention to carrying out Mr. Stephenson's ideas in the construction of wrought-iron tubular girders for railway purposes, and as they are likely to be extensively adopted, we have collected some information as to their cost and weight compared with solid iron girder bridges. It appears that the tubular girder for spans of 60 feet and upwards is in many respects superior to the arch, whether it be of iron, stone, or brick, besides being much cheaper in construction.

The arch, as is well known, is not always admissible where railways have to be carried across public thoroughfares, deep ravines, navigable rivers, and canals. In such situations, the horizontal wrought-iron girder bridge appears to be the only structure which can with safety be applied to such a purpose. Cast-iron girders are applicable for spans not exceeding 40 feet; beyond that point the compound trussed girders have been used, and in every case they are equally if not more expensive and much less secure than those composed of wrought iron, and it is doubtful whether the principle is a sound one. Now, in the wrought-iron girder the weight is less than one-third of the cast-iron, the strength being the same, and as these girders form the parapet of the bridge, they are particularly well adapted for a bridge of considerable span.

In order to show the commercial value of this description of bridge, we give the comparative cost of one of these bridges compared with one of cast-iron, from bridges actually constructe d.

Truss Girder Bridge.—The weight and cost of a bridge of 60 feet span having cast-iron trussed girders.

Cast-iron work 76 tons at £12 per ton .	£	912	0 0
Wrought-iron work as composed of truss-rods, bolts, &c., 14 tons at £37 4s. . . .		520	16 0
Total for the girders, exclusive of cross beams and roadway	£	1432	16 0

We believe it possible to make a compound girder of the above span entirely of cast-iron riveted in parts, but the increased weight and additional cost would render such a structure inadmissible for such a purpose.

Cost of Stephenson and Fairbairns's wrought-iron bridge.

Three wrought-iron girders, each 66 feet long, riveted complete, weight 30 tons, at 30*l.* per ton, 900*l.*, which is the sum required for the girders, exclusive of the cross beams and roadway as before.

The comparative value of the two bridges will therefore be as 9 to 14, irrespective of the superior strength and security of the former to that of cast-iron, in whatever form it may be applied.

The plan has already been adopted by Messrs. Stephenson, Cubitt, Vignoles, Bidder, and others, and Mr. Fairbairn during the earlier stages of the experiments engaged, at the request of Mr. Vignoles, to construct two bridges of this kind—one to be erected over the canal and the other over the turnpike-road on the Blackburn and Bolton railway. These bridges were the first constructed for the support of a railway,* and although they are probably not so well proportioned as others now in progress, they nevertheless exhibit such extraordinary powers of resistance as not only to ensure complete success, but to lead to new and future developments in what may probably be considered a new era in the history of bridges. Viewing the subject generally, we feel assured, from what has already been done conjointly by Mr. Stephenson and Mr. Fairbairn, that the present discovery is only a beginning of an extensive application of this useful art.

Since the completion of the first experiments on sheet-iron tubes, others of a more conclusive character, and upon a much larger scale, have been made. They indicate several new and important facts; and from the greatly increased size of the model tube, with its rectangular cells, greatly superior powers of resistance have been obtained by a considerable increase to the area of the bottom. The ratio of that part to the cellular top, will now stand as 10 : 12, instead of 3 : 5, as formerly indicated in the experiments with the corrugated top.

Through the kindness of the Editor of the *Railway Chronicle*, we have been enabled to give drawings and an account of one of the bridges, that over the canal on the Blackburn and Bolton Railway.

"Fig. 1, represents an elevation of the side girders, each 66 feet long, with a span of 60 feet. Fig. 2, a transverse section of the bridge. Fig. 3. a side view and section of the cross beams; and fig. 4, a section of one of the side girders, including its suspended cross beam and platform.

"The thickness of the plates used in the construction of these girders was half an inch for the sides and top, and $\frac{5}{8}$ inch for the bottom; the whole firmly riveted to angle iron, as shown in the sections.

"On referring to the sections it will be observed that the wood cross-beams, D, D, for supporting the roadway and rails, are screwed up to the bottom of the hollow girders by the straps *a a*, and the vertical bolt *b*, which perforates the top cell through the tube *c*, and answers as a stay for connecting the upper and lower sides of the cellular top. Since these bridges were finished, a better and more efficient mode of construction has been adopted, by forming a longitudinal shelf of plate-iron along the bottom of each girder, to receive the cross beams, and also to strengthen the bottom in its resistance to a tensile strain. In this construction it will be observed that the cross beams may be formed of either cast-iron, wrought-iron, or wood, as may be deemed expedient."

This Blackburn and Bolton bridge has already been subjected to severe tests. Before the line was opened to the public, three locomotive engines each of 20 tons, and covering the span of 60 feet, were run together as a train, at rates varying from 5 to 25 miles per hour. The deflection produced by a weight of 60 tons was ·025 of a foot. This seemed to be without any sensible alteration from the difference of velocities. Captain Coddington, the government inspector, and Mr. Flannigan, the engineer, then placed on the rails, in the middle of the bridge, two wedges of the height of one inch, acting as inclined planes. The engines dropping from this height when at a speed of 8 to 10 miles per hour, caused a total deflection of ·035 of a foot. With wedges of an inch and a half thickness, the total deflection became ·045, which is nearly half an inch. Altogether, it has been fully proved that the bridges are strong enough to bear any force to which they may be subjected, whether brought by a dead weight or by impact.

* Simultaneously with these constructions, Mr. Dockray erected, under the direction of Mr. Stephenson, a similar bridge, with a cast-iron top, for carrying the turnpike-road across the London and North-Western Railway at Camden Town.

MR. FAIRBAIRN'S WROUGHT-IRON GIRDER-BRIDGE OVER THE LEEDS AND LIVERPOOL CANAL.

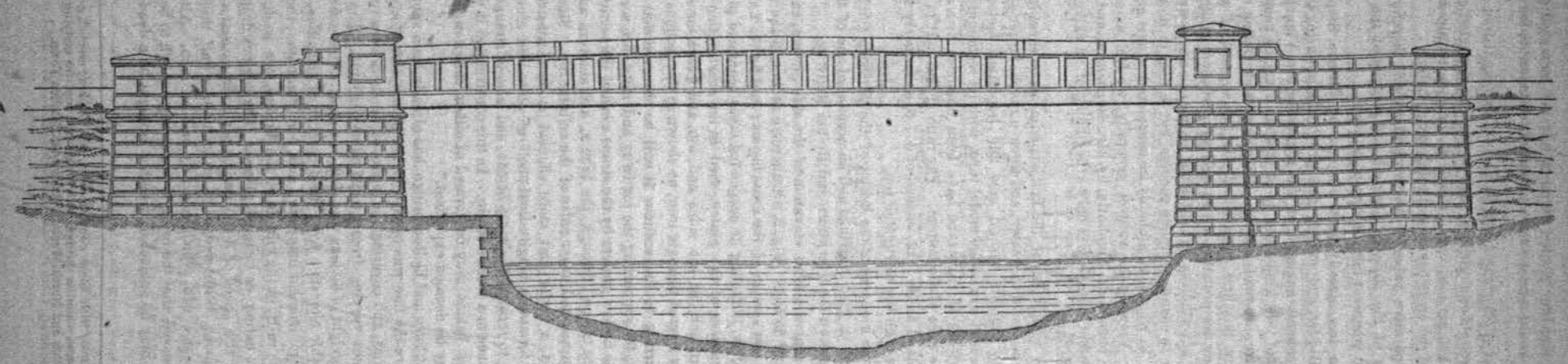


Fig. 1.—Elevation. Span, 60 feet.

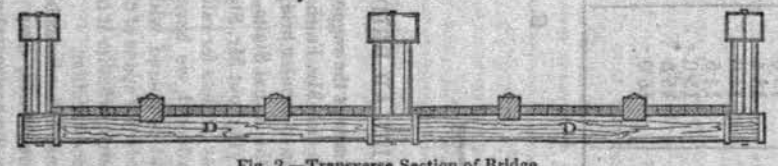


Fig. 2.—Transverse Section of Bridge.

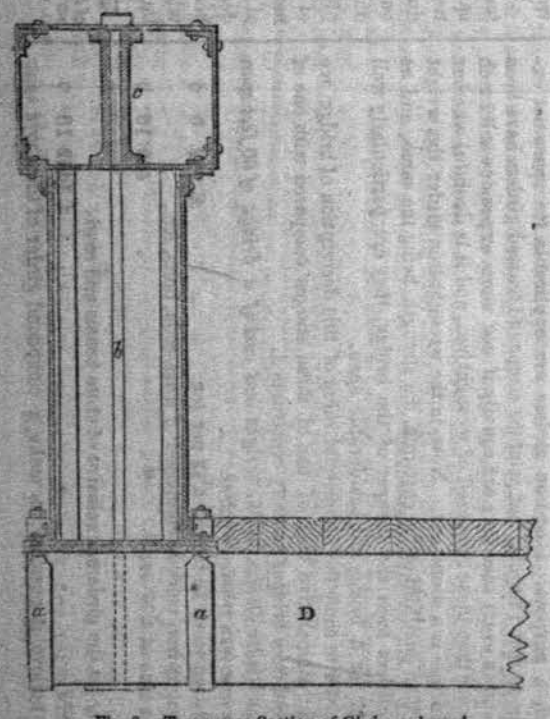


Fig. 3.—Transverse Section of Girder enlarged.

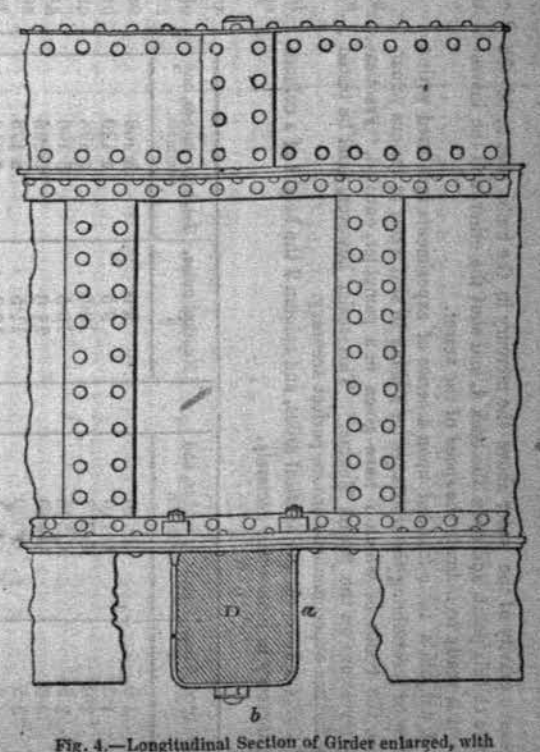


Fig. 4.—Longitudinal Section of Girder enlarged, with Cross-Beam.

HISTORY OF ARCHITECTURE IN GREAT BRITAIN.

A Brief Sketch or Epitome of the Rise and Progress of Architecture in Great Britain. By James Elmes.

"Epitomes are helpful to the memory, and of good private use."
Sir Henry Wotton.

(Concluded from page 341.)

A celebrated politician in the last century acquired the name of Single-speech Hamilton, from the circumstance of having delivered an oration of much promise and great ability, and never again opened his mouth in parliament: so likewise may the architect of one of the most original and tasteful buildings in London be designated by the title of Single-house Wyatt, from his only public work, the Trinity-house, on the north side of old Tower-hill, now called Trinity-square. If John Nash be more polystructural than Samuel Wyatt, the latter may plead that although his progeny be not numerous, his single production is a lion.

This building is a handsome stone and brick edifice, and extends from Cooper's-row on the east to Savage-gardens on the west, with extensive lateral fronts to both of these streets, and consists of a main body and two wings. The principal story is of the Ionic order, raised upon a rusticated ground story. Above the windows are some beautifully sculptured medallion portraits of George III. and his queen, sculptured panels in low relief representing genii with nautical instruments, and four of the principal light-houses on the coast. These sculptures are so beautiful in style and execution, as to deserve being moulded, and casts made from them by the Royal Academy for the use of their students. The style of architecture used in this building is neither so pure as that selected by Stuart for the internal portal of the chapel at Greenwich, so pedantic as that copied by Wilkins in his portico of Downing-college, Cambridge, nor so fanciful as that used by the Adams in the Adelphi; but is a successful adaptation of the Ionic order to proportions of his own, with too much elaboration of foliage in the capitals, trenching on those of the Corinthian. The mechanical execution of every part of this elegant building cannot be too much admired; so beautiful is the masonry and the brickwork of its exterior, that the best workmen both in brick and stone would find models for imitation. The first stone was laid September 12, 1793, by the master, assisted by the deputy-master and elder brethren of the corporation, and the offices opened for business in 1795.

Among the later cotemporaries of Chambers, Wyatt, and Taylor, were—Thomas Leverton, who held an office under the late Mr. Fordyce, in the Crown-lands' Revenue department, and is best known by the extensive and substantial mansion called Wotton-wood-hall, in Hertfordshire, which he designed and built for the late Paul Benfield, Esq., and Grocers'-hall, in the city;—Richard Jupp who held the important office of architect and surveyor of buildings to the East India Company;—and one or two others of lesser eminence. The north front of the East India-house in Leadenhall-street is a pleasing instance of Mr. Jupp's taste and skill in his profession. It is of considerable extent in front, and of greater dimensions in depth; the whole building, or series of buildings, cover a large area of ground facing Lime-street on the east, and Leadenhall-market on the west. The principal front is composed of a six-columned Ionic portico, slightly projecting from two lateral wings. The narrowness of the street in front, and the great value of the ground on which the building is erected, compelled the architect to adopt this flat relief of his principal front; but he has overcome this difficulty with great ability, by constructing a deeply-receding porch or inverse portico behind the columns, which gives a depth of shadow and a bold relief to the design, while it affords a goodly shelter to the directors and other members of the establishment from the easterly and westerly winds whilst waiting for their carriages. The capitals, beautifully carved by an uncle of Sir Richard Westmacott, our eminent English sculptor, are a free and artist-like imitation of the temple of Apollo Didymæus. The triangle of the pediment is filled with sculptures in entire relief by Banks, of which it is not too much to say that they exceed any figures in such a situation that have yet been executed in England. The subject is George III. in Roman imperial armour, protecting the commerce and interests of the company. The king is extending his shield, placed on the right arm, over the principal figure, and resting with his left on a sheathed Roman sword. This circumstance gave rise at the time to an opinion that the artist had worked from an inverted tracing of a design made by an eminent painter, who was well known to have furnished designs for many of the sculptors of his time. The artist, however, defended himself by asserting that the king being represented in protecting the Arts and Peace, the attitude was correct. Cæsar, however, did not enter the senate-house with the cuirass, sandals, sword, and shield of the warrior, but in the peaceful toga and laurel crown, with which it is said he covered his baldness. On the upper acroterium of the pediment is a statue of Britannia, and on the two lower, figures of Europe and Asia.

A very pretty four-columned Doric portico, in a pure Greek style, forms a suitable sub-entrance, through a well proportioned hall, to the minor offices in Lime-street, and shows how quickly this architect imbibed the pure style then recently introduced by Stuart,—for he had been originally educated in a thorough Roman school. Mr. Jupp's portions of this building were began in 1799, and finished about 1805. The elevations of the gigantic warehouses which he erected in many of the eastern parts of the metropolis are very harmonious in their proportions, and exhibit great skill in the use of his very simple materials; gateways, warehouse doors, windows, and piers constructed of simple brick and stone.

The elder Mr. Dance, whose principal works have been before described, left an able successor to his place of architect to the city of London, and to his professional business, in his son, George Dance the younger, who received the honourable addition of R. A. to his name from the Royal Academy of Arts, and was appointed to the chair of Regius Professor of Architecture in that institution; but was too fond of enjoying his *otium cum dignitate*, ever to impart his knowledge to the members and students of the Academy. The family of Dance hold an honourable station in English history; for, in addition to the two architects, one of them was an able comedian in the time of Garrick, particularly celebrated for his personation of Falstaff and other fat heroes of the buskin, to which his corporeity, like that of the celebrated Stephen Kemble, lent an aid that no stuffing could accomplish. Another, Nathaniel, became eminent as a portrait painter, and was, like his younger relative, an R.A. His portraits for identity of resemblance and character of the person represented by his pencil, take a place between those of Reynolds and Romney; less graceful and natural in colouring than the former, he equalled the latter in all the best qualities of a portrait painter. This gentleman resigned his diploma and his palette for a baronetcy, a fortune, and a change of name, as Sir Nathaniel Dance Holland. Another member of this family added a singular triumph to the naval glories of his country, by saving a large and valuable homeward-bound East India fleet, under his command as senior captain, and therefore commodore, of this mercantile squadron. He manœuvred his unweildy and richly-laden ships with such nautical skill and dexterity, when attacked by a superior French fleet of men-of-war and frigates under the command of Admiral Linois, defending himself with such gallantry and well-directed broadsides, though manned by a company of merchant seamen and Lascars, sufficient only to work and not to fight his ships, that the French admiral retired from the contest with serious loss and discomfiture. This gallant action, which stands completely by itself in naval history, procured for its hero the honour of knighthood and personal thanks from his sovereign, a vote of thanks and an honourable reward from the East India Company, and the acclamations of all his admiring countrymen. The English have a propensity to give familiar titles to their favourites, naming one the Hero of Acre, another Nelson of the Nile, the Cock of the Rock to the gallant defender of Gibraltar; so they named Sir Nathaniel Dance the Fighting *Ingy* (India) man.

To return to our subject, the younger Mr. Dance designed, among other buildings of lesser note, two prisons for the corporation of London—Newgate, and Giltspur-street Compter; the former is situated at the corner of Newgate-street and the Old Bailey, and derives its name from the ancient city gate so called, which stood across Newgate-street, between Aldersgate and Ludgate. It was a prison of great antiquity, and as late as 1457, Newgate, and not the Tower, was the prison for the nobility and great officers of state. Being much damaged by the fire of London, it was repaired and beautified by Sir Christopher Wren, in 1672. In one of the niches was a figure, representing Liberty, with the word *Libertas* inscribed upon her cap, and with a cat at her feet, in allusion to the story of Sir Richard Whittington, who bequeathed a sufficient sum to rebuild this gate, which was satisfactorily done by his executors in 1423. This statue, with

another of similar rude sculpture, are preserved in two niches in the Old Bailey front of the present building.

On the removal of all the city gates except Temple-bar, the corporation of London resolved on building a new and more capacious prison, in the room of Newgate and Ludgate, the latter of which was appropriated solely for debtors who were citizens of London. The duty devolved upon Mr. Dance, the city surveyor, who accordingly prepared his designs, and the first stone was laid on May 23, 1770, by the lord mayor (Alderman Beckford.) This was the last public act of this eminent and patriotic citizen. The prison was broken into by the rioters in 1780, the prisoners set free, and the interior burned. It was speedily repaired, and after several recent improvements and alterations has become the city and county felons' gaol. On a continuous rusticated ground story are erected a central building and two wings, deeply recessed from each other, and producing thereby an harmonious proportion of light and shade. The governor's house and offices, some of which have been occasionally used for state prisoners under punishment for political offences, occupies the central building, and in the solid wall between it and the wings are constructed doors of solemn and gloomy aspect, leading to the two different departments of the prison. Over these doors are representations in sculpture of fetters, chains, and handcuffs, such as were formerly in use for felons. These, with the entrance-doors and windows to the governor's house, are the only apertures next the street, and, with the coarse chamferred rusticated stones of which the building is composed, and the massive modillion cornice and plain blocking course with which it is surmounted, give an air of sombre melancholy appearance to the building, truly characteristic of the purpose for which it was erected. Indeed, it may be considered as one of the most characteristic designs that ever emanated from an architect's mind. When viewed from the western end, from which the lateral front next Newgate-street being that of the north wing, with its deep recesses terminating with the south wing next the court-yard, which separates it from the sessions-house, the merits of the design are peculiarly striking.

The other prison, that called Giltspur-street Compter, owes its origin to the same cause as the former, and was erected in the stead of two or three smaller, dilapidated, and less commodious houses of detention. It is situated on the eastern side of Giltspur-street, in a line northward of Newgate. The elevation is composed of a centre and two wings projecting from the main body of the building, which is of Portland stone, laid in rusticated courses, and as it is more a house of correction for misdemeanors, and for the detention of untried prisoners till taken before a magistrate, than a penal gaol, it has a series of small semicircular headed windows, and a single central door next the street. For the same reasons, the design is less gloomy, and also less picturesque, than its more solemn neighbour; yet it is an excellent and very appropriate design.

The Lunatic Asylum of St. Luke's, Middlesex, is another work of the same architect, the original building, which was established by voluntary contributions, as an improvement upon the royal hospital of Bethlehem, being taken down to make way for the new square and other buildings on the Finsbury estate of the corporation of London. It stands on the north side of Old-street-road, and is an extensive and lofty building, consisting of a centre and two wings, bearing a just and harmonious proportion to each other, and to the buildings which unite them. They are divided into a series of semicircular recesses and piers. The semicircular part, which is near the ceiling of each story, gives light and air to the cells without exposing the unhappy inmates to the gaze, and often derision, of the multitude, as was the case in the old hospital in Moorfields. Its whole aspect is commanding and highly characteristic of the use to which it is designed, and shows how far genius may use even the plainest materials—this building being, like many of Palladio's, plain brick and a few simple stone dressings; and it is not too much to say that few buildings in our metropolis, or perhaps in Europe, surpass this for unity and appropriateness of style.

The Royal College of Surgeons, on the south side of Lincoln's-inn-fields, is another example of the genius of this tasteful architect. The building is very extensive, occupying a large frontage next Lincoln's-inn-fields, and a great depth to its south front in Portugal-street. The principal front is decorated by a six-columned portico of the Ionic order, tastefully adapted from the Ilissus, with a proper entablature and acroteria. In the frieze is inscribed—"Collegium Regale Chirugorum."

Upon the acroteria above the entablature are a row of antique bronze tripods, attributes of Apollo Medicus, the ancient tutelary god of surgery. Over the centre intercolumniation is a massive shield, on which is sculptured the armorial bearings of the college, supported by two classical figures of Æsculapius, with his club and mystic serpent. In the interior are a spacious and handsome museum, board and council-rooms, libraries, conversation rooms, a handsome hall, and domestic apartments.

The Royal Academy thought so well of the principal front of this building, as to propose it as a fit subject for the competition of its architectural students, who were required to present two drawings, one in outline, figured from actual measurement, and the other shaded and tinted; when their first silver medal was awarded for the best drawings to Mr. George Allen, whose premature death was mentioned in these pages a few months since.

The college have recently made large additions and improvements to this building, by adding two columns to the portico, an additional length on the front, and many alterations in the Interior, under the direction of James Barry, Esq., R.A., architect of the new Houses of Parliament.

The gallery of the British Institution, in Pall-Mall, is another instance of this architect's taste and invention. The principal front is amenable to no architectural law; yet it is a beautiful architectural composition. The picture galleries are harmonious in proportion and well lighted. It was originally built for the first Alderman Boydell, for the reception of the pictures that were painted at his expense, for his splendid edition of Shakspeare; and was called, until its present occupancy, "The Shakspeare Gallery." Its use was indicated by one of the most elegant pieces of sculpture ever executed in modern times, representing the apotheosis of Shakspeare, by Banks.

The south front of Guildhall, another work of this architect, has received much censure from not having fallen within the rules of any style of Pointed architecture hitherto executed. That Mr. Dance was not ignorant of the proportions of Gothic architecture, although he might not worship it with all the fervour of the black-letter Dr. Dryasdusts, may be proved by his able restoration of the ancient church of St. Bartholomew the less, before the rebuilding of the interior by Mr. Hardwick. The façade of Guildhall belongs to no style, and is amenable to no laws; but may be considered as a fanciful dream of its inventor, composed of civic ornaments of swords and maces, caps of maintenance, shields, and other civic heraldry, embellished with windows neither Gothic nor Hindûstanee, but a mixture of both, as if some of the pictures of his eastern friends, Hodges and Daniells, with some of Wren's, had been floating before his eyes like dissolving views. The porch is surmounted by a row of queer-looking ornaments, resembling nothing so much as the back flaps of George the Third's life-guards. It is, however, a picturesque and most original composition. Whatever faults may be attributed to Mr. Dance's front to the Guildhall, they are more than compensated for by his well-proportioned, original, and elegant chamber erected for the meetings of the common council of the city of London. The room is of the proportion of two cubes, the centre being given to the body of the court, on the floor of which are ranges of seats for the commoners. The western half-cube is raised above the level of the court, and is appropriated to the chair of the lord mayor, a bench on either side for the aldermen, recorder, and sheriffs, with a seat and table below for the accommodation of the town-clerk, the common crier, and the clerk of the court. The eastern half-cube is separated from the body of the court by a bar, at which counsel, petitioners, and other persons who have to address the court, appear. From the door below the bar is a passage leading to a commodious reporters' box at the further end; and at the eastern end of the chamber is a spacious gallery for persons wishing to hear the debates, which is free to every one so long as there is room. The centre of the court is covered by an elegantly-proportioned spherical cupola, supported on four segmental arches, and lighted from above by a capacious circular lantern. In the spandrels under the cupola were formerly four allegorical figures, painted by Richard Westall, R.A., but being much injured by damp were removed. At the upper end of the chamber over the lord mayor's chair is a fine marble statue of George III., executed by Chantrey, at a cost of upwards of 3,000*l*. Under each pendentive of the cupola is a marble bust on a lofty pedestal of Nelson, Wellington, and Granville Sharpe. The walls are decorated with several fine historical pictures and portraits, many of which were the gift of the first Alderman Boydell.

One more building of this Mr. Dance must be mentioned, for the bold originality with which he violated one of the first principles of his art, and which may be condemned by Palladian pedants, as the Dryasdusts have his Guildhall-Gothic—namely, the little church of St. Alphage, in London-wall. The ancient church on this spot escaping the fire of London, became, about the time the additions to Guildhall were proceeding, so dilapidated, that it was rebuilt from this architect's designs. The singu-

larity above alluded to consists in having elliptical columns, instead of circular, where, being attached to the wall in a very narrow street, great projection could not be obtained; and consequently produce a better effect of light and shade, from the depth of the undercutting, than either pilasters or semicircular columns.

Although Carlton-house, the palace of George IV. when Prince of Wales, has been removed, and the Theatre Royal Drury Lane which preceded the present one has been burnt down, they both possessed architectural qualities too great to suffer the name of their architect, Henry Holland, to pass unnoticed. The former consisted of a centre and two projecting wings; the portico was six-columned, of the Corinthian order, selected from the temple of Jupiter Stator at Rome, the capitals of which are singular for the intertwining of the inner volutes. This portico was presented by George IV., on the taking down of Carlton-house, to the trustees of the National Gallery, and were adapted by Mr. Wilkins, the architect of that edifice, to the central building. Drury Lane Theatre, that was celebrated for the triumphs of Mrs. Siddons, the Kembles, and Sheridan, its talented proprietor, was, in their opinion, and that of all theatrical critics, the very *beau idéal* of a dramatic theatre; nor has its equal been since erected in England. On the summit of this stupendous edifice, the architect had erected a lofty octagon tower, somewhat resembling the Temple of the Winds at Athens, the apex of which he surmounted by a colossal statue of Apollo with his lyre, as the god of music and dramatic poetry. It is singular that, at the awful conflagration which consumed this truly national structure, and caused the House of Commons to adjourn its proceedings in pity to the misfortunes of their brother senator, considering it a general calamity,—the statue of the god, surrounded by flames that reached far above its head, and looking as if in the crater of a volcano, was almost the last object that fell with a death-like crash amidst the fiery mass that was blazing in the pit of this once elegant theatre. This architect also built the first Pavilion at Brighton, for the Prince of Wales. It was a neat, unassuming, sea-side villa, decorated with a few Ionic columns, like those of the Ilissus. This building also met the fate of Carlton-house, and was taken down to make way for the present heterogeneous structure.

One of his buildings, however, did escape destruction—Melbourne-house, Whitehall. It occupies a large space of ground between the Horse Guards and the Treasury, with two fronts—one towards the public street, Whitehall, and the other facing the Mall in St. James's-park. The entrance-front, next Whitehall, is decorated by a four-columned Ionic portico, of the Ilissus order, which, extending to the curb-stone of the footpath, allows carriages to come close to its plinths, and set down visitors under its roof. The footpath is continued under it, which often affords to passengers a friendly shelter from the rain. Right and left of the portico are columns of the same height and proportion, detached from the wall, with projecting entablatures profiled over them, which, with the great projection of the portico, give a play of light and shade too seldom found in the street-fronts of our public buildings. This front has no other aperture but the entrance-door, which opens into a spacious hall, covered by a spherical cupola, which leads to the internal apartments of the mansion. It was built for the late Duke of York, and, from the circumstance of the somewhat overwhelming appearance of its huge cupola, which seems almost to crush the little portico beneath, it gave rise to a ludicrous saying, that Mr. Holland had lodged the Duke of York in the roundhouse, and the Prince of Wales in the pillory. The latter remark alluded to the long Ionic screen that separated the courtyard of Carlton-house from Pall-Mall, through which the portico and the two wings seemed to peep like the head and two hands of a prisoner in that instrument of punishment. On the nothing-to-do appearance of these columns, an Italian architect, the elder Bonomi I believe, inscribed the following epigrammatic question and answer: addressing one of the isolated trunks, he asks—"*Cara colonna che fate qua?*" to which he makes the stone reply—"*Non sapiamo in verita!*" I quote from memory and hearsay, and know not into what *Charivari* of the day to refer for a correct version, if in error. Mr. Holland's other works were on and about the great building speculation of Sloane-street and its neighbourhood, and may be regarded in a similar light, as to architectural character, to those of the Adams in the Adelphi.

As it has been customary to give additions to the names of eminent princes, such as Louis the Great, Charles the Bald, Richard the Lion-hearted, so a cotemporary biographer of the Brunswick family proposes to call the successor of George III. "George the Magnificent." As regent and sovereign of these kingdoms, he exhibited a love for architectular splendour more capricious than tasteful. Gaudiness was more esteemed than elegance, and George the Magnificent delighted more in the costly extravagance of the Dioclesian school, than in the tasteful grandeur of Pericles and Phidias. John Nash was exactly the architect to the regent's mind; and gilded profusion usurped the place and overlaid the purer taste that had been introduced by Chambers, Wyatt, Stuart, Dance, and Holland. Hence, George IV. preferred the gorgeous profusion of the Roman school in its decline, to the sublimer truths of the Athenian in its greatest purity; hence, he preferred the pretty beauties of the Dutch and Flemish masters, to the sober and less apparent magnificence of the Roman school; hence, he preferred cabinets and *bijouterie* to works of sterling merit; hence, he preferred Canova to Phidias; and hence, all the bad taste that emanated from the patronage of George the Fourth. He decorated all the lower apartments of Carlton-house, low in height as well as in situation, with Corinthian columns, redolent with burnished gold from abacus to plinth; so bright, indeed, that their proportions could not be scanned, and their only excellence were their extreme cost. This suite of apartments, which were level with the gardens next St. James's-park, and beneath the splendid suite of state apartments designed by Holland for levees and other regal purposes, were furnished, by the architect, the cabinet maker, the carver and gilder, the upholsterer and carpet maker, with almost Tiberian luxury, for the personal use and comfort of the regent and his favourites, who could make their exits and entrances by the back way in the park, without ever going up to the public and royal part of the regent's palace. This costly and, as Holland left it, tasteful edifice, he swept away, and pulled down Buckingham house, the favourite residence of his father, to make way for the present Buckingham-palace, which all the patchings of Blore have not been able to lick into decent shape: neither has it a tasteful exterior nor a comfortable interior, as the complaints made to Parliament, of the want of domestic accommodation, fully prove. He removed the pretty Pavilion at Brighton for the capricious nondescript which now so expensively occupies its place. Before the removal of Carlton-house, when George IV. entertained the greatest assemblage of princes and warriors that, perhaps, ever met together at the English court, after the great and terrible triumph of Waterloo, the entertainments were both extravagant and childish. A canal, filled with real water and living fish, meandered among the tureens and *plateaux* of the dinner table, till the unfortunate sufferers were killed and nearly cooked by the heat of the soups, the viands, and the *entrées*. There was also erected in the gardens a circular revolving temple or tent, moved by invisible machinery, designed by the chief architect whom the prince deigned to honour, for the admiration of the imperial, royal, and gallant visitors to the regent of England. This building is now applied to a very useful purpose, being the model-room at Woolwich-arsenal. There was also a fragile Chinese bridge thrown over the canal in St. James's-park, which, had it been consumed by the illuminating lamps that showed its barbaric proportions to the gazing multitude, as it was threatened, it would have been spared the disgrace of a sarcasm and an early destruction from premature decay. When Canova, shortly afterwards, visited this country, partly to view our metropolis, and principally to feast his eyes upon the unequalled beauties of the Elgin marbles, he was accompanied in most of his perambulations by an amiable and eminent living architect, whose name I may not mention without permission. He was so delighted with the simplicity and durable construction of Waterloo-bridge, that he demanded of his guide if it were not built at the public expense? He was informed that it was erected by private, untitled individuals; but, if he would accompany him a short distance, he would show him one built by royal command at the public expense, "from the designs and under the superintendence"—to borrow a favourite expression of our craft—of the chief architect to the crown. He took his friend Canova to St. James's-park, he pointed with supreme derision to the pagoda bridge, and exclaimed—"Behold the work!"

Nash must not, however, be judged by these royal puerilities; for no man should be estimated by the worst, but by the best of his works, unless the former so far preponderate as to overwhelm the latter. Regent-street and the Regent's-park will carry the names of George IV. and John Nash, as patron and architect, with considerable applause to a late posterity. The clearing away of the narrow streets, dirty alleys, and filthy courts, without sewers or underground water-courses—a very honeycomb of cess-pools, and hive of sordid abominations—that existed between Oxford-street and Pall-Mall, to make way for a broad, handsome, and varied

thoroughfare, from the New-road, Marylebone, through the handsome *cul de sac*, Portland-place to St. James's-park, is not only a work of great sanitary welfare to that portion of the metropolis, and has opened a necessary thoroughfare from Westminster to the wealthy district of Marylebone, but is one of the greatest architectural improvements that have taken place in the metropolis between the reigns of Charles II. and George IV. The great sewer alone that extends from Portland-place to Whitehall, and purifies, by its various branches, a portion of the metropolis equal in extent to many a city, would have done honour to the names of Agrippa and Cato the Censor.

The expense of purchasing the ground and property, and interests upon it, was enormous; but the calculations of the architect, and the powerful support he received from his royal patron, enabled him to accomplish, after many and annoying obstructions, this vast undertaking. When the plan for the street and the sewer was completed, the ground was offered to public bodies or individuals, under severe restrictions as to external design and quality of materials, at heavier ground rents than had ever before been paid for houses of retail business. Sites for public and private buildings were taken, as the speculators or builders required; and as fast as portions of the main street were finished, and became connected with lateral streets, they were opened to the public.

Nash did not compel any of the lessees to employ him as their architect, but left every one to make their own choice, reserving to himself and the commissioners for carrying the works into execution a right of rejecting such plans as did not accord with the intended style of the street. From this cause arises the pleasing variety that distinguishes Regent-street from the monotony of many of its more opulent northern neighbours. Instead of single houses, it consists of many fine rows of houses, some of which would not disgrace a palace or royal residence, and might be taken for such did not the subdivisions of the shops or offices show their application. Many of these, as Waterloo-place, the Quadrant that leads from it to Regent-street, the mansion that he built for himself on its eastern side and some of the best connected series of houses, and the two Circusses, that connect the great crossings of Piccadilly and Oxford-street by a continuation of the main street to Langham-place, are from the designs of Nash. Some of these, to hasten the completion of the work, he undertook himself as a building speculator, which neither amended his fortune nor increased his comforts; but Nash was a bold, enterprising man, and had a spirit not easily daunted by difficulties. The other architects who principally contributed to this great undertaking were Soane, who will be mentioned hereafter, C. R. Cockerell, the younger Repton, Decimus Burton, the two Smirkes, and the elder Abraham, who being happily in the land of the living, their works do not come into this portion of our history, which will close with the works of our respected predecessors.

Nash's other great work, the Regent's-park, shows the talent of this eminent artist to great advantage. The arrangement of the roads, canal, lake, and plantations, which were all finished and in a growing state before scarcely a house was erected, exhibits the power of Nash's mind in grasping a whole, and his taste as a landscape artist to great advantage. So little did he care about the minor details of his art, that he either knew not or contemned the differences between the schools of Greece and Rome; for once, when engaged in a conference with him, relative to the galleries of the Society of British Artists, which he built from my designs, he inquired why I spoke disparagingly in the "Annals of the Fine Arts," of his architectural taste,—he was asked if he really preferred the mean and meagre capitals that he had employed in the exterior of his own house in Dover-street, and in the porticoes of Waterloo-place, over those of the Ilissus? He replied, that an Ionic was an Ionic, and he did not care which his draughtsmen used. But it is remarkable that he ever after employed the latter, as may be seen in the before-mentioned two Circusses, and some of the more northern buildings of this street.

This beautiful and highly-decorated park bears testimony to the liberality of Nash's great patron, who not only dedicated this portion of the crown lands, previously known as Marylebone-park, to the public, but presented the magnificent royal library of his father to the British Museum, and a splendid collection of casts from some of the finest antique statues in Rome to the Royal Academy, for the use and benefit of the British public. The Regent's-park is bounded on the south by the New-road, from which it has five entrances, two between the east and west sides of Park-square, opposite Park-crescent, Portland-place; one between Ulster-terrace and York terrace; one opposite Marylebone-church, called York-gate; and another opposite Baker-street, between Cornwall-terrace and Clarence-terrace;—on the west by a new road leading to Lisson-grove; on the north by Primrose-hill; and on the west by streets reaching to the Hampstead-road. The Regent's-canal encircles nearly the northern half, carried through a beautifully-planted valley. In the centre is a circular road, called the Ring, within which are the beautiful gardens of the London Botanical Society.

The principal terraces and buildings that surround or stand within the park are chiefly from the designs of Nash himself, and two or three by living architects; but the limits of this work do not permit more than a brief mention of some of the best, which are—York-gate and terrace; Sussex and Clarence terraces, named after two of the prince regent's brothers; Cornwall-terrace, named after the second title of the heir-apparent to the British throne; Hanover-terrace, after the reigning family; the menagerie and gardens of the Zoological Society; the royal hospital of St. Katherine, removed from the site now occupied by the St. Katherine's-docks; the Colosseum, a building more resembling the Pantheon of Agrippa than the gigantic structure whose name it assumes; the Diorama, and the villas of the late Marquis of Hertford, Sir Herbert Taylor, Lady Arbuthnot, and that of the late Mr. Burton, called the Holme, beautifully overlooking the spacious lake, and a few others of less distinction. Of Mr. Nash's other works, which are tolerably numerous, the limits fixed to this concise history will not allow me even to name: many of them are some extensive mansions and villas, town-halls, and similar buildings, principally in Kent and Sussex, which are all marked by his peculiar taste, which was neither pure by nature nor refined by study. He was rather a great building projector than a tasteful artist. His taste in landscape gardening, which combines the beauties of Kent and Brown, founded upon the purest English models, was less artificial than those of Le Notre and other masters of the French school, whose formalities are proverbial. Nash lived to a Nestorian age, and, if unlike Wren in anything else, he died, like him, neglected.

A few works of some celebrity must be introduced rather parenthetically, and more briefly than I could have wished. The Auction-mart at the bottom of Bartholomew-lane, opposite the north-east corner of the Bank of England, occupies a situation too public for its slender pretensions to either taste in design or skill in adaptation; the staircase, which leads from the hall to the numerous public auction-rooms in the upper stories, is narrow, steep, and dangerous to a fault—in that portion of a public building which, above all others, ought to be capacious and easy of access. It was erected from the designs of the late Mr. John Walters, who obtained the honour of being selected from a number of his cotemporary architects, as the author of the best design submitted to a committee of auctioneers. This architect also designed Stepney new church, situated at the rear of the London-hospital, Mile-end. It is in the later Pointed style, which appears more congenial to the architect's taste than those of Greece and Rome, for it is altogether better as a work of art than the preceding. It has large transverse windows at each end, and smaller ones of a similar character in the north and south sides. Being finished with octagonal turrets and pinnacles at each end, without either tower or spire, it bears a greater resemblance to a collegiate chapel than to a parish church. The pulpit, galleries, altar-piece, roof, and pewings are of solid oak, carved, moulded, and panelled; resembling in durability of materials the best works of our best church architects. It was erected in 1819, but its amiable architect died young, and much lamented, before its completion.

The offices of the Board of Control, Cannon-row, Westminster, built originally for the Board of Ordnance, by the late William Atkinson, Esq., is an extensive building with two fronts, one facing the river Thames, and the other next the before mentioned street. The Ionic portico of its principal front is one of the best proportioned and most aptly applied in the metropolis. It is four-columned, with a pediment after the best canon of the order—that of the Ilissus. The entablature is continued on each side of the portico, and terminates at the angle of the principal front.

The late King William IV., although never aspiring to the title of a connoisseur in art, yet showed a sound judgment in selecting for his chief architect the late Mr. Jeffrey Wyatt, to enlarge and embellish the ancient royal palace at Windsor, which had been patched by Wren, added to by James Wyatt, and botched by Nash. The additions made by William IV. were extensive, judicious, and in good taste. He expressed his views to his architect, and left him to complete them. He honoured him with knighthood, and, to give him a distinction among the numerous family of his name, he augmented his patronymic to Wyattville; and Sir Jeffrey of that name became distinguished by the favour of his sovereign, and by the taste he exhibited in his additions to Windsor-castle. He completed the

noble quadrangle, and perfected the entrance began by his uncle, James Wyatt, and known as George the Third's staircase; finished some and added others to the noble suite of domestic and state apartments, which are now so generally admired. He rebuilt and added to many of the external towers and other buildings on the principal terrace; and brought the whole exterior into a unity of design, that it never possessed since the days of William of Wykeham, its original architect. He also raised the Keep, or Round-tower, nearly 100 feet above its former altitude; and rendered the whole mass of buildings of which this magnificent royal palace is composed, to a unity of design that its former heterogeneous mixture of styles apparently bade defiance to.

Sir Jeffrey Wyattville began his career as an architect rather late in life, having practised the more profitable business of a builder at the western end of the metropolis. He, however, showed a great love for art from the earliest period of his life, and often exhibited designs, of great taste, in the annual exhibitions of the Royal Academy:—one, a picture in oil of Priam's palace, as described by Homer, showed inventive talent of the highest order. Sir Jeffrey published a beautiful series of his works at Windsor-castle, which ought to be in the hands of every lover of this noble art.

Downing-college, Cambridge, Haileybury-college, Hertford, University-college, London, and the buildings containing the National Gallery and the Royal Academy, on the northern-side of Trafalgar-square, are from the designs of William Wilkins, R.A., formerly Regius Professor of Architecture in the Royal Academy, and author of several works and delineations. These buildings are all of one family, one school, one style—pedantry. Grecian art, instead of giving freedom and beauty of style to the designs of this artist, Minerva seems to have frozen up all his faculties by the terrors of her ægis. So much Greek, so much gold, was a saying of Samuel Johnson; and so much Greek, so much *cold*, was the practise of William Wilkins,—for no liberty would he give or take, no line or member would he use but for which he could not find a precedent in some ancient Greek building—and the older and more formal it was the better. He was a Greek puritan and an archaic methodist. The Corinthian portico of the National Gallery is Holland's, or it would not have been so luxuriant in its foliage. But he has frozen the entablature by his Hellenic coldness. Had he been a sculptor, he would have cut off the Hyacinthian locks of the god of Day; he would have deprived Jupiter of his ambrosial curls, as Delilah did Sampson,—and sent them both into Olympus like a couple of Roundheads. As to the interior of the building, the Royal Academy may well regret the greater dimensions and finer proportions of the large exhibition-room and well-proportioned council-chamber, designed for them by Chambers, and decorated by the pencil of Reynolds. The exhibition-rooms of the National Gallery are unworthy of the name, and some of our auctioneers and picture-dealers have better. As to the portico, it is, from its situation, but of little use; and the Royal Academy are obliged, during their exhibitions, to erect a temporary wooden one beneath and without it, for shelter and shade. At Carlton-house, it was a useful addition to the building: in this place, it is a useless application, stuck up for the admiration of gazing cabmen and hackney-coachmen, whilst loitering upon their stand.

The portico at University-college stands in the same category—useless, and, therefore, an unnecessary appendage to the building. The architect has also mistakenly placed the staircases to the principal story outside of the structure, instead of within its walls, like a Swiss chalet. Should the Emperor of Russia, in imitation of the Empress Catherine, erect another ice palace at Petersburgh, no man could have executed the freezing task so well as the cold and chaste architect of Downing-college.

Yet Mr. Wilkins was a learned man, was a graduate of the University of Cambridge, an accomplished Greek scholar, and, perhaps, the best educated classic that has honoured the profession of architecture since Sir Christopher Wren. Had the talents of Mr. Wilkins been directed solely to literature, Grecian archaiology, the higher branches of mathematics, or to an accurate delineation of those antiquities which he so profoundly admired, he would have obtained a higher standing among the great men of his country, than he does among its architects; lacking, as he does, the architect's greatest qualities—invention, and freedom from pedantry. Had he been sole dictator of art, no style would have passed current in his realm, but the hard, dry, cold Greek of the oldest times, without a shadow of invention to give it vitality. His was the very mummy of the art,—as cold, as lifeless, and as much bound up by the bands of precedent. It is the Greek style of Mr. Wilkins that has wearied so many of its warmest admirers.

The Bank of England, the new Treasury-chambers, before their recent alteration by Mr. Barry, the royal entrance to the old House of Lords, affectedly called by its architect "*La scala reggia*," and some others of his earlier works, show the exuberance of the fancy, while the sound judgment and good taste that acknowledge the rules and precepts of the greatest masters of the art, place Sir John Soane on a level with any English architect since the days of Jones and Wren. Whilst the puerilities and freaks of fancy indulged in in his own house and museum, Lincoln's-inn-fields, the Dulwich-gallery, the new buildings at Chelsea-hospital, and the National-debt-office, in the Old-Jewry, exhibit a wild exuberance of novelty, unchastened by the sober rules of art, it has stamped them with the character of what the Italians would call *Capriccios*, rather than severe compositions. His greatest work, the Bank of England, whether taken as a whole, or considered as a series of detached buildings, erected at several periods, and subsequently brought into a whole by the hand of taste, is a work of singular and sterling merit. The long north front next Lothbury, is simple, grand, and imposing, and is among his earliest and best productions. The west front, next Princes-street, whilst the ugliest of all forms in architecture, an acute angle, which the junction of the two fronts form, is overcome in an original and masterly manner. This is managed by cutting off a considerable portion of the unsightly angle, and converting it into a slight recess; and the two fronts are gracefully connected by a circular portico of columns and pilasters, the entablature of which is surmounted by a beautiful acroterium, over the obtuse angle at the back of the portico, under which is an unoccuped niche, corresponding with those in the Lothbury front. Soane, undoubtedly, had in his mind the semicircular porticoes of the north and south transepts of St. Paul's (of which he has often expressed to me his most ardent admiration), when he placed this segment of the circular temple at Tivoli to conceal this ugly corner. He has, by this means, not only overcome an unforeseen difficulty, but converted what would have been a blemish in common hands into a positive beauty. So original, so happy, and so beautiful, is this gem of our art, that the committee of architectural students of the Royal Academy made it the reverse of their medal, which they struck in honour of their eminent professor, and presented to him before his retirement from public life. It has been proposed, and the thought is a happy one, that a statue of its architect should be placed in this vacant niche, and thus supply all that is wanted—a figure to this unique design. The small quadrangle called the Lothbury-court, is a design of surpassing beauty and elegance. A recessed portico on the right hand, and on the left lead to the bullion-office and other important offices of the Bank; whilst four detached columns of the same order, supporting statues of the four quarters of the globe, conduct, through a semicircular-headed gateway, to the interior apartments of the edifice. That portion of the quadrangle which immediately faces the great entrance gates, possesses a magnitude and beauty sufficient for a triumphal arch. The architect was so justly proud of this design, that he erected a copy of the columnar portion of it, upon a smaller scale, as a decoration to the front of his own villa at Ealing. The ample rotunda, formerly used as a stock-exchange, but now as one of the dividend-paying-offices, is a grand, simple masterpiece of art; as is the large office at the north-west corner of the building, decorated with lofty Ionic columns of beautiful Greek proportions, with a vaulted ceiling. These beautiful and correct works are among Soane's first and best productions. The front next Bartholomew-lane was next in point of time, and shows a greater tendency towards an excess of ornament than the preceding ones. This elevation abutted for some time upon Sir Robert Taylor's Corinthian pavilions, which were afterwards taken down, and the Soaneian style carried on in Threadneedle-street, from both ends, till they joined the centre of the original building, erected by George Sampson, in the reign of William III. This, finally, gave way to the present new centre, which is by no means the happiest of Soane's designs. Thus the Bank became completely isolated, and has but one entrance in each street:—that in Lothbury has been before described; the one in Bartholomew-lane leads to the rotunda and other public offices for the payment of dividends and transfer of stock; the three next Threadneedle-street, which may be considered but as one, lead through a spacious court to the hall, the front and interior of which exhibit a fair specimen of Sampson's style as an architect. The entrance next Princes-street is, I believe, never opened. Thus there are but three entrances to this immense treasure of enormous wealth; nor can a more appropriate building for such a purpose be imagined. The order used is that of the circular temple at Tivoli, known to every connoisseur of picturesque beauty; but which is of such obscure origin, as to be unknown whether it was dedicated to the goddess

Vesta, or to the sibyl so well known in ancient Roman history. Soane was the first architect who ever used this rich and beautiful variation of the Corinthian order since the days of its original inventor.

I am sorry that my proscribed limits have compelled me to treat the works of many of our greatest architects, particularly Wren, Nash, and Soane, with such brevity; but as I, *at present*, propose to enlarge this Memoir, and to illustrate it by engravings of the best works of every period, I respectfully bid farewell to my friendly readers.

JAMES ELMES.

THE BRITISH MUSEUM.

No. V.

The Egyptian remains are particularly interesting, as they show the state of manufacturing art in a country which was the great centre and school of art for many ages. With Egypt the Phœnicians traded, exchanging the productions of that country for those of Greece, the Levant, and the West Mediterranean. The Egyptians were not fond of the sea, and the outward trade was always in the hands of strangers, first Phœnicians, and then Greeks. This was a circumstance which favoured the Phœnicians, for it prevented the rivalry of the most advanced country, at a time when the nations in the Mediterranean were all in a state of barbarism. It is to this trade of the Phœnicians that we, perhaps, owe the specimens of Chinese workmanship which have been found in Egypt, and some of which are now preserved in the British Museum. The trade to the Indies long passed through Egypt, but it is uncertain whether the traffic carried on by the Phœnicians, and Solomon, king of the Jews, from Ezion Geber, on the gulf of Akaba, in the Red Sea, was anterior to that of the Phœnicians or not. From Egypt the useful arts were carried direct to Greece, and in all probability to Etruria and Italy; an enterprise not more difficult than the intercourse between Tyre and Carthage. The traditions of Greece afford many examples of the influence exercised by the polished natives of Egypt; and the latter country was long regarded with reverence as the great seat of learning. The Jews seem to have acknowledged the same superiority in the craftsmen of Egypt.

Egypt had particular advantages in those days as a manufacturing country. It had good supplies of flax, the material of the great woven manufactures; and it had a large working population, supported at a cheap rate. It seems likewise to have been free from home war. Egypt was defended by its deserts, its seas, its swollen river, and its many canals, more than by the courage of its inhabitants, or by the possession of large material resources. It is true, Egypt fell under the rule of the Persians and the Greeks, but these cases of great invasions were different in their effects from that of frequent and harrassing wars, or the petty wars carried on between the towns of Greece. The history of Egypt in this respect is like that of China, which, although it has succumbed to successive Tartar invasions, has enjoyed a settled state at home. The great cities of Memphis and Thebes had greater populations than the most flourishing and powerful Greek states, and accumulated on small spots a large body of artisans, who were favourably placed for carrying out a subdivision of employment. Many manufactures were thus carried to a great pitch, as there is witness enough in the British Museum to prove to us. Indeed, down to the latest period of what may be called "antiquity," Egypt was a great seat of manufactures.

The Egyptian collections have been much improved of late by the addition of proper labels, giving as good an interpretation as possible of the names of the chief personages represented. These collections are the more pleasing, as they contain sufficient to give a very good idea of the public and private life of the Egyptians. The colossal heads of Rameses are fair specimens of their large works; while the common tools, instruments of the toilet, or articles of dress, illustrate their more trifling pursuits. Admirable as is the Greek collection for its works of art, it is wanting in the smaller specimens. The Roman collection is deficient in larger articles. The Etruscan gives us representations instead of the objects themselves.

The Rosetta stone (No. 24) is what first deserves attention, as it may be regarded as the key of the whole system. This monument seems to have been placed in a temple at Rosetta, dedicated by Nechao to Atum. It is of basalt, and contains three inscriptions on the same subject, one in Egyptian hieroglyphics; a second in Egyptian demotic or enchoreal character, a more familiar character or mode of writing; and a third in Greek. The inscriptions are mutilated, and record the services which Ptolemy the Fifth had rendered to his country. They were engraved by order of the high priests, when assembled at Memphis for his installation. The name of Cleopatra likewise occurs. The tablet has lately been put in a frame.

It will be remembered that from this tablet Dr. Young derived his theory of hieroglyphic interpretation, which he tested by its means. As the name of Ptolemy occurs so frequently in the Greek, Dr. Young thought that the corresponding group in the hieroglyphics would be found nearly as often. This proved to be the case, but afforded only one result—the discovery of the name of Ptolemy. The name of Cleopatra likewise was found, and Dr. Young thought it worth while to examine whether the hieroglyphics forming the name corresponded to the letters or syllables of the Greek. If so, the groups answering to Ptolemy and Cleopatra would to some extent correspond, as each contains the P, T, and L. Dr. Young found this to be the case, and thus obtained the elements of an alphabet, which has been extended and applied to such extent, that the dictionary of hieroglyphics now includes many thousand words.

The results of this discovery were not confined to their operation on Egyptian hieroglyphics, but have had an influence on another recondite department of learning—the interpretation of the arrow-headed characters, which, like that of the Egyptian hieroglyphics, so long baffled inquiry. The possession in museums of a few bilingual inscriptions in Arrow-headed and Hieroglyphics was of no avail, so long as both remained undeciphered; but with the unlocking of the secret of hieroglyphics, these inscriptions have acquired great importance. The names of Xerxes, Artaxerxes, and other Persian kings, have been recognised on these monuments, the Egyptian cartouches having been interpreted, and thus give materials for an alphabet of the arrow-headed character, which now engages the attention of many able and persevering students.

The tablet of Abydos (No. 117) is another valuable monument. It was found by Mr. Banks, in a chamber of the temple of Abydos, in 1818, and it was published by M. Cailliaud in 1823, and by Mr. Consul Salt in 1825. It was conveyed to France in 1837, and at the sale of M. Mimaut's collection, it was bought for the British Museum. It represents an offering made by Rameses 2nd or 3rd, of the 18th or 19th dynasty, to his predecessors in the kingdom of Egypt; but it is not yet ascertained whether the list of kings be chronological or genealogical. Originally, it held the names of fifty-two kings, arranged in the two upper lines, or twenty-six in each line. The first twelve names of the first line and the first eight names of the second line, have been destroyed. It still has the names of many kings; and it is probable that the discovery of other monuments will give ample materials for a sound system of Egyptian chronology, a matter of some artistic importance, as it will give us exact ideas of the relative ages of the works which we possess, and will throw very great light on the history of ancient civilization.

We may observe, by the by, that in the prosecution of hieroglyphic researches, it is very likely that in late monuments and inscriptions, Greek and Latin terms and words will be found inscribed in hieroglyphic characters, for such in other cases is what may be termed a not unusual philological phenomenon.

Two not the least interesting illustrations of Egyptian art are undoubtedly the two colossal heads in the Grand Central Saloon, and in the vestibule of the Egyptian Room. The former is a plaster cast of the face of the northern Colossus at the rock temple of Ipsambul, and represents the king Rameses 2nd. The other is likewise a plaster cast of the same monarch, but the countenance does not seem to be the same. These heads, of colossal proportions, raised so high, and seated as it were on terminals, giving some idea of the trunk, are no less remarkable for their vast size than for the harmony of their expression. To give a full idea of their original grandeur, they should be placed still higher; but as it is, their effect is most imposing, and fully justifies the artistic conceptions of the Egyptians in their colossal works. To the uninstructed multitude, the contemplation of these figures, godlike in form, must have been impressive of awe. They walked, as it were, among the gods upon earth, who were present in all the sublimity of heavenly form, clothed with all the terrors of superstition, and armed with all the weapons of imposture; statues of a hundred feet in height, which might be well supposed to hear their votaries, when, as in the case of the vocal Memnon, they were known to have the power of public speech. Indeed, we can scarcely contemplate unmoved the mighty relics now before us.

The artist will admire that in works so great, breadth and smoothness should be so well preserved, and he will not fail to recognise the hands of

great masters. We cannot understand Egyptian art, unless we see it in its bolder works, and then we acknowledge its sublimity. The smaller tablets and statues, the lines of hieroglyphics, and the grim figures, would give us too low a standard of Egyptian skill. In these smaller works they show only their weakness; in the larger works they show their strength; and they have left few rivals. Such a work as the Alexander statue at St. Petersburgh, sinks into insignificance in the presence of the vast outlines of a Rameses, or a Sesostris; and what we now call colossal, measured by the latter standard, becomes unworthy of the name.

The history of some of the monuments in the Museum has often points of interest. Thus, No. 23, the chest of a large sarcophagus of Hapimen, a royal scribe, was brought from Grand Cairo, where it was used by the Turks as a cistern, and named "The Lovers' Fountain." Death had evidently lost its terrors, and in the lapse of ages awe had given way to love. The origin of the modern legend would be curious if it could be traced. The colossal scarabæus (No. 74), removed from Egypt to Constantinople, was brought by Lord Elgin to London. This scarabæus was sacred to the god Tore or Cheper, and was at a later period the emblem of the world. It is a right kingly emblem for the modern Babylon. No. 10, a large chest of the sarcophagus of the king Necht-her-hebi, Her-necht-hebi, or Amyrtæus of the 28th dynasty, was at one time in the mosque of Saint Athanasius, at Alexandria.

Beneath No. 43, is one of the casing stones of the great pyramid at Gizeh, showing the angle of inclination of the sides and the material. It is a calcareous stone. It was brought home by Colonel Howard Vyse in 1838.

What cannot fail to be noticed in many of the larger monuments, is the high polish of the granite, porphyry, or serpentine, which has been well preserved during so many ages. It excites wonder that so much should have been done with the rude means at the command of the Egyptians.

The number of sepulchral monuments belonging to the Egyptians has afforded large supplies for the Museum. These record priests, judges, scribes, and officers of all kinds, and are rather of an inscribed than of an artistical character, though they supply many useful illustrations. A modern cannot but be struck on seeing such proofs of the respect paid by the Egyptians to their dead, of how much behindhand are the English in this respect. Large sums are lavished by us on the idlest and meanest shows; the hire of black carriages with hearthbrushes on their tops, or black horses with long tails, and of blackguards of drunken and dissolute appearance; while the object for whom this unpicturesque and unmeaning procession is got up is consigned to a common grave, and left without the slightest memorial of his existence, or of the regard of his friends. So far is this real disrespect of the dead carried, that the metropolitan cemetery companies have been obliged to put a check on an economy of the rites of sepulchre, which is exercised at their expense and in favour of the undertakers; for it was no uncommon event for a procession of mutes, hearses, carriages, and horses, to consign a bedizened coffin to a common grave.

The money which is spent on funeral show is one of the greatest oppressions of the widow and orphan, who, in compliance with the conventions of society, in order to do as their neighbours do, are forced to spend money on cloaks, feathers, hat-bands, and coffin-trimmings, which they can worst afford in the moment of their severest bereavement. The abolition of this show by those who are above the fear of idle clamour, would render a great service to those classes of the community whose means are limited, while it would allow of the disposal of funds in a manner much more respectful to the deceased, and much more useful to society.

Whoever has observed, has had reason to regret that in later times sepulchral memorials of individuals, even of eminence, are rare in England, and this at a time when there is enough of public and private wealth. Our great show tomb-houses of Westminster and St. Paul's, flatter us that we are not wholly forgetful of duty towards the departed; but we have only to look elsewhere to witness the general disregard of sepulchral monuments: old ones are suffered to fall into decay, and new ones are not raised. The peer, the bishop, or the judge, leaves large wealth behind him, and ungrateful heirs. It is true, public feeling has been better shown towards public men, and officers of the army raise regimental monuments to their deceased brethren; but there is no proper public provision for monumental commemoration, and little private feeling in its favour, although the cemeteries have made some improvement. We want, first of all, a public fund for monuments, and we want next the disbursement by the wealthy classes of some portion of those moneys now wasted upon undertakers. This applied in monuments would give us many valuable works of art, and would be a most laudable exercise of patronage in favour of sculpture, a branch of the arts much and undeservedly neglected in this country, though its cultivation is to be desired. The successful study of sculpture would not only give an impulse to architectural decoration, but it would have its pecuniary bearing on our pottery, our glass manufactures, and on many branches of trade in which the plastic arts exercise an influence.

In the upper Egyptian Room the visitor has his attention drawn to the many articles of glass or glazed ware. As the Etruscans are characterised by their painted vases, so may the Egyptians be by their blue glazed ware. The cases are filled with figures of this material, which are found by thousands in the tombs, being attached to the network or the necklaces of mummies. This alone must have constituted a large branch of manufacture; but the ornaments in the cases in the middle of the room are no less remarkable. Beads and drops, of clear and coloured glass, formed a great part of Egyptian jewellery, and there are many good designs of bead and bugle work, which might be thought to be modern, so neatly are they carried out. Although light blue or bluish green is the favourite colour, yet there are beads of black, white, red, yellow, and scarlet, allowing of great variety in the patterns and designs as worked. The beads and bugles are likewise of many sizes, from the smallest bead now made to a large bugle or eardrop.

The cases in the upper room contain a great variety of objects; they form, indeed, an ethnographic museum of the Egyptians, affording specimens of many domestic objects—indeed, as copious illustrations of Egyptian life as the general student could well desire. The practical man will likewise find particular interest in the tools and materials here collected, and which show the advancement of the Egyptians in many branches of manufacture, not generally supposed to have been then successfully cultivated. In some, the workmen seem not to be surpassed in modern times, and they certainly prosecuted with success most of the useful arts.

The general character of Egyptian workmanship is neatness, and this will be seen in the wove cloths, mats, beadwork, jewellery, cabinet-making, glass-work, and other articles. The Egyptians were very precise in repeating a pattern, so that some complicated designs are carried out with all the accuracy of modern machinery. In this respect the Greeks and Romans were not so proficient; neither are other modern nations so proficient as the English. Even the mat-work is well finished, and the cloth is as well woven as could be desired. Some of the mummy cloth is very good. The inlaying in the chairs and other cabinet work is very fairly done, and the wood work is well finished off in most cases. The metal wares are likewise well wrought, and the bronze kettles are as finely turned as could be desired by the most fastidious. Alabaster vases formed a very successful branch of Egyptian manufacture, and the many which are to be seen in the Museum are cleanly finished inside and out, seemingly by the lathe. The Egyptians supplied plain and coloured glass to the Greeks and Romans, and there are some bottles in the Museum, with broad bottoms, which are of very fair size. The glass articles are, however, generally small, being phials, beads, and articles of ornament. The specimens of Egyptian crystal in the Museum are not so good as those in the Roman collection, but which it may be presumed are likewise of Egyptian workmanship.

Some of the specimens of enamelled portraits are among the most interesting relics of Egyptian art, and it is to be regretted that we have not more of these relics, which are of a durable character. One figure, in low relief, in which the colours of the head dress are well burnt in and enamelled, is particularly to be admired.

The glazed earthenware figures are generally covered with hieroglyphics in black, and glazed with blue. The Egyptians had the means of beginning the porcelain manufacture in Europe, but though there are specimens of plates with designs, the Egyptians did not prosecute this manufacture to any extent, or the demand for decorated pottery would have been large among the Romans. It was left for modern times, after the introduction of Chinese porcelain into Europe, to carry out the porcelain manufacture. As the Egyptian decoration was chiefly confined to hieroglyphics, there seems to have been no demand for their glazed figures among other nations.

NEW LIGHTHOUSE APPARATUS.

Mr. Alexander Gordon has for many years directed his talents and attention to lighthouses, and, after extensive experience in fitting and improving the lights, has at length produced, under the highest auspices, a system of lights so powerfully concentrated as to promise in their adoption a very great advantage to ocean and river navigation. One of these lights was exhibited lately at Messrs. De Ville and Co.'s manufactory, 307, Strand.

Fig. 1.

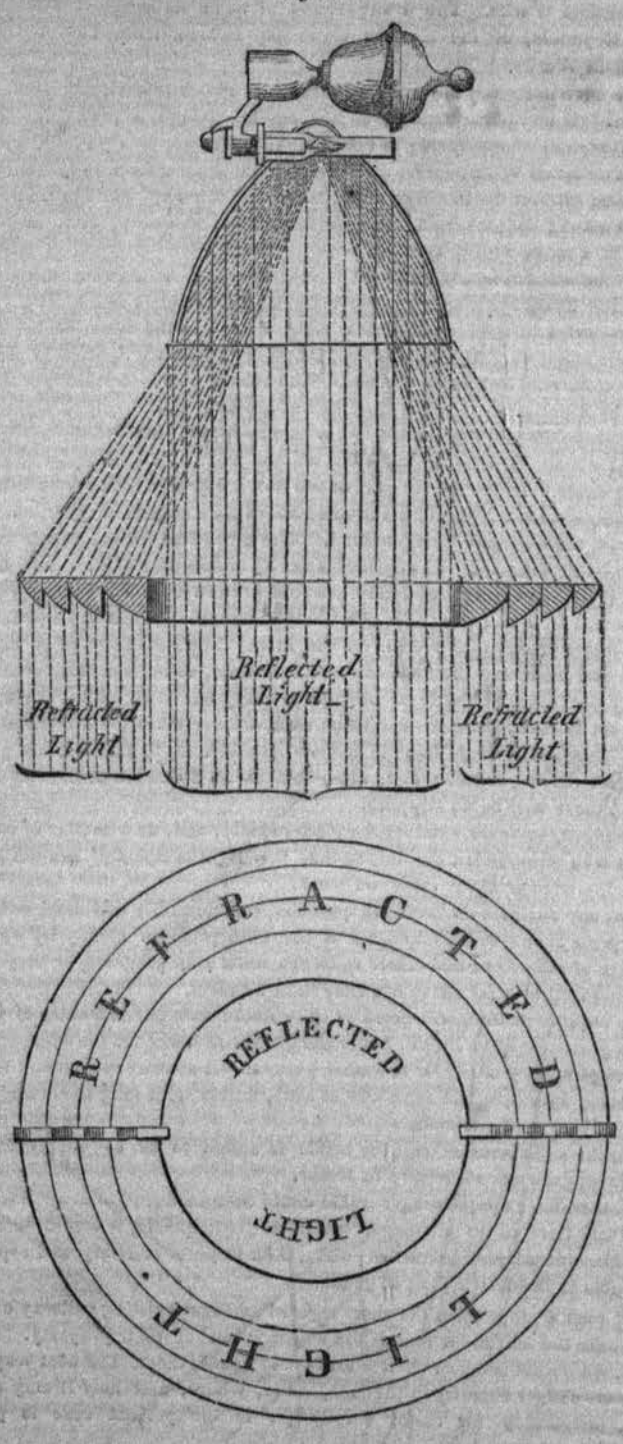


Fig. 2.

Previously to describing the new light, we will give a short historical account of lighthouse lights. About the year 1792, glass refractors, five inches thick and twenty inches diameter, were substituted for reflectors, the focal point being nineteen inches distant; and they were to be seen in use in an English lighthouse as late as the year 1832. Buffon had proposed to reduce such a refractor in thickness, by cutting the lens into steps, so as to absorb less light. In 1811, it occurred to Sir David Brewster that a lens, or set of lenses, might be built of separate pieces of glass. In 1819, the late M. Fresnel proposed that the generating sections of the rings not only ought not to have the same centre, but even that the different centres should not be situated on the same axis of the lens. A few years afterwards, M. Fresnel engaged M. Soleil to construct eight such lenses for the lighthouse of Corduan. In 1827, the Trinity Board witnessed some experiments with a lens of the kind, which had been made by Mr. Gilbert, under the direction of Sir David Brewster. In 1828, that board imported a lens from France. In 1833, Mr. Gordon introduced a polyzonal arrangement (both dioptric and catoptric), constructed by M. Maritz, of the Hague. And, subsequently, the Trinity Board, and particularly the Commissioners of Northern Lights, at the instance of Mr. Alan Stevenson, introduced the French system extensively in England and Scotland. In 1840, Mr. Gordon constructed a revolving light for Jamaica, with Huddart's reflectors, and without refractors. In 1843, the Bermuda lighthouse tower, constructed by Mr. Gordon, was lighted by Fresnel's system, contrary to Mr. Gordon's desire, who recommended very large prolate reflectors. In 1846, he introduced a fixed light for the Point de Galle lighthouse.

The new system of lights exhibited by Mr. Gordon is a following out of his prolate reflectors, as applied to the Ceylon lighthouse, by saving the radiated light which formerly escaped past the lips of the reflector. This latter portion of the light, which was formerly lost, is now bent down and thrown into the beam, as shown in the annexed engraving.

The specimen light exhibited was a single one, of great concentrated power; and although the light was only about an inch in diameter, from a common Argand lamp, its dazzling brilliancy was scarcely subdued at a distance of 50 yards. In this light, Mr. Gordon has combined a very prolate reflector and the refractor of Sir David Brewster deprived of its central portion; and by this system he is enabled to throw into a beam nearly $\frac{77}{78}$ths of the whole light generated by an Argand lamp. The parabolic or conic reflector is fixed horizontally, and opens at 13½ inches from the light; at a diameter of 15½ inches, and at 14 inches from the mouth of the reflector, are fixed glass zones used as the refractors, being composed of four circles (each in three pieces), varying in size and thickness,—the inside face being even, and the outside of the glass cut away into curved steps, to prevent useless portions from absorbing any of the light, as shown in the engraving, fig. 1.

Mr. Gordon proposes to use these new "systems" in some lighthouses immediately.—For Revolving Lights: To use one or more of these systems, each furnished with an Argand burner, on one or more revolving faces, according to the size of the required beam.—For Fixed Lights: To use such a number of these systems as will light the circle (of 360°), or any required portions of the circle; twenty-four systems, each with its own lamp, for the whole circle, and twelve systems for the half circle, and so on: one system to 15°.—For Flashing or Intermitting Lights: Such combination of these systems as the situation may require.—For Steam-ship Lights, or Railway Lights: A similar but smaller system; the source of light being any that is known and convenient for the required purpose.

RAILWAY EXTENSION FOR SPEEDY TRAVELLING.

If there be one thing that has more than another served the purpose of retarding railway progress, it is to be found in the dogma so studiously put forward on all occasions by "authorities"—meaning thereby railway makers—that "Speed is Weight," even though weight be not always speed. Whether on the broad gauge or on the narrow, weight has been constantly increasing in the process of competition; though it was evident to all who took the trouble to examine, that speed was not increasing in proportion to weight. Let any one examine or watch the rails on any railway while an engine, with from six to nine tons on each driving-wheel, is passing over them,—let any one watch the deflection of the rail, whether on the continuous bearing of the broad gauge or the bridge rail of the narrow,—and he will be satisfied that the process, even on the nominally level line, is really that of ascending a constant gradient, varying from 1 in 30 to 1 in 70. The process is that of driving a wave of rail before the driving-wheels of the engine, just as the bows of a steam-vessel drive a wave of water before them. We believe, in short, that the process of propulsion on railways is analogous to skating—that the adhesive impulses are given at intervals on hard points, such as well-packed sleepers; and it is on this principle only that the constant, irregular action of the draw-

springs can be accounted for. As regards durability, there can be no question that the continuous bearer of the broad gauge is far superior to the bridge rail of the narrow,—and probably that may account for much of the alleged advantage in working expenses. The want of continuous bearing in the mode of laying rails in chairs on cross-sleepers is a serious evil. At the joint chairs the strength of resistance is not one-third that of the intermediate chairs, and therefore it is that the passenger counts every joint as he passes over them. The cross sleepers at the joints are beaten down, and the ground is hollow beneath them. Water gets in, and "maintenance of way" increases in amount. The rails hammer in the chairs, the keys get loose, and danger becomes imminent. If there be one rule more important than another in "maintenance of way," it is that of making the whole road, both rails and substructure, of equable resisting power throughout. It were better and safer to have a flexible rail throughout, than one alternately hard and flexible; and therein is the prominent advantage which the structure of the broad gauge has over the narrow,—though probably, taking the weight of the engines into comparative account, the rails of the narrow gauge are better proportioned as to size than those of the broad. The importance of this question will be obvious to every mechanical mind. Equal movement in all moving machinery is the thing aimed at in every case where durability is desired. Why else are fly-wheels—and why are blocks of iron placed on engine wheels to balance them? Why is it sought to keep locomotive cylinders as close as possible to the central line of the train? What but for equal movement? And yet the rail is so contrived as to produce continually-recurring blows at every joint. This must be amended before economy can be obtained.

That the railway dogma, "Weight is Speed," is a fallacy, may be gathered from the whole animal creation. The swift eagle, when divested of his wings and feathers, is reducible to a very small bulk of body. The slow goose or duck is chiefly body, with but small wings. The swift Arab horse is light, but muscular, like a double-cylinder engine, working by pure elasticity. The slow Flanders horse is like an atmospheric engine of the olden time, the muscles only serving to put the gravity in action. Who ever dreamed of applying a Flanders horse to a fast coach? Who ever dreamed of applying an Arab steed to draw a coal-wagon? Yet this is what railway competitors have been doing up to the present time. Elephants, leviathans, were a fitter term than horses. We have heard that there are existing engines weighing 35 tons, and that engines yet in embryo will, when they achieve their monstrous birth, weigh 40 tons. It is some years since a strange nondescript, called Harrison's Patent, was produced on the broad gauge. It made a trial—but all its try ended in standing still. We asked a "rude unlettered driver of the rail" why it did not answer. The answer was concise,—"It weighs forty tons." That reason is fast getting to be obsolete. If the proportion of engine weight to train weight continues to increase as it has done for some time past, the horse will soon cut up the carriage. As a rough and ready acquaintance remarked,—"The train is nothing; anything can draw these carriages, so long as the engines can draw themselves."

Many men have had their doubts of the truth of the railway dogma, "Weight is Speed." One man—a railway officer—was found bold enough, after some preliminary thinking, to put the dogma to the test of experiment. Having had constructed for him a manumotive carriage, he found that considerable speed could be attained with a light vehicle, but the speed was limited by the limited strength of man. To get a steam locomotive constructed for a speed of twenty miles per hour, and weighing only 5 cwt., was his next problem,—the object being to lift it off the rails to get out of the way of fast trains. Builders were found to undertake this: the axles were made as light as those of a pony gig, the wheels of wood, and all parts reduced to the minimum. It worked, and would ascend an incline of 1 in 19; but the boiler was not well arranged, and the axles were too close together for steadiness. It was taken in again, the axles set ten feet apart, and a new boiler applied. But there were two serious defects: the axles were too light for the increased weight, and the wheel tyres were too narrow for the "points." It was evident that, as in most cases of alteration, the parts were not fitted to each other. The second trial was made, and it soon became evident that the engine would go, but not for any length of time. As predicted, the engine went off the rails at the points, strained the axles, and again came into dock. New wheels, of iron, were applied, and stronger axles; and those who predicted, first, that the engine would not go, and, secondly, that it would fly off the rails by reason of its lightness, were out in their calculations in both cases. The maximum speed attained was 47 miles per hour—40 miles the average of 56 miles from London to Cambridge. The total weight, with fuel and water, was 22 cwt., and the number of passengers were eight, including the driver. On that memorable day the dogma, "Weight is Speed," was extinguished for ever. One hundred-weight was on nd equivalent to thirty hundred-weight, and the vehicle was steadier at maximum speed than a first-class carriage.

The railway officer who established this fact, of measureless importance to all future railway progress, is Mr. Samuel, the resident engineer of the Eastern Counties railway. The builders of the engine are Messrs. Adams, of Fairfield Works. The draughtsman of it in its original tiny form is Mr. Reynolds, of the Eastern Counties, and formerly a pupil of the Fairfield Works.

We have not given the working drawings of this remarkable production of foresight and perseverance, as the engine, though a practically useful machine, and money-saving to the Company, will not be a pattern, but will be far eclipsed by its successor. We give the general form and dimensions, as being all that the intelligent mechanic would really desire to know.

An oblong box, the frame being of angle-iron, measuring 14 ft. in length, by 4 ft. 4 in. in width, is suspended by axle girders in spiral springs, beneath the axles of and within side four wheels, each 3 ft. 10 in. in diameter, the axles being 10 ft. apart. The axles are three inches in diameter. One of the axles is double-cranked at right angles, in the usual mode, and to this the connecting rods of a pair of steam cylinders are applied to produce motion, also in the usual manner. The oblong box is divided about midway by a partition. At the front end of the box thus divided, is placed a vertical boiler and the machinery, with the driver, the whole being contained within the base of the four wheels, and supported below the level of the axles. In the hinder part of the box are placed seats for seven passengers, some along the sides and some above the axle, which passes through the box, the entrance being behind. The cross-seat for the driver has the water-tank within it. The cylinders are 3½ inches diameter, with a 6-inch stroke. The reversing gear and link motion are as usual. The diameter of the boiler is 1 ft. 9 in.; the tubes are in number. It has been proved by cold-water pressure to 200 lb. on the inch. The consumption of coke is 2 lb. per mile, and the total expense for driver, coke, and oil is under one penny per mile. It will be obvious to every one that, with a pressure of only six to seven hundred weight on each driving-wheel, "maintenance of way" need not be taken into the account, as where six to nine tons are placed on each driving-wheel; and, also, that as no deflection of the rail takes place, there will be no slipping.

Changes, however, cannot take place rapidly, and, as a matter of course, those who propounded the dogma that "Weight is Speed," are not likely to acknowledge their error off-hand.

But our business is with the question, commercially and mechanically. The press teems with complaints of the absorption of money by the extension of railways; and either railways must stop progress, or they must be produced at a far cheaper outlay than hitherto.

As regards passengers, speed is the object: as regards goods, weight is the object more than speed; but when goods are borne on the same rails as passengers, they must, for the most part, travel at the same rate of speed. Differing speeds on the same line of rails, unless with long intervals, are a fruitful source of collision.

On the main lines of rail the traffic is stated to be so enormous, that goods wagons are constantly in arrear.

If, therefore, the passenger traffic could be transferred to other lines, exclusively devoted to passenger traffic at great speeds, it would be a very considerable advantage to the public, both in point of safety and rapidity, and also in the forwarding of goods.

At such a proposition the short-sighted amongst existing railway owners will take the alarm, for fear of the depreciation of their property. However, we do not see how their alarm could benefit them. The best way is to look all danger steadily in the face, when, where, and how it may occur. But, fortunately for them, the danger in the present case is purely imaginary.

It will, we believe, be a conceded point, that the public would prefer frequent trains carrying small numbers of persons, to unfrequent trains carrying larger numbers, and would also prefer increased speeds. And, provided it can be made apparent that they can thus be carried also more cheaply, we presume that both directors and shareholders would agree as to its desirability.

Now, in the first place, a large train involves the use of a heavy engine,

as at present managed. It also involves an amount of station-room and servants, both at the termini and intermediate stations, proportioned to the numbers of the passengers. This large amount of property and persons are employed all at once, but with long intervals.

In the second place, the large train involves great momentum and greatly-increased dead weight to support shocks. It also involves the use of much heavier rails and roadway, bridges, embankments, viaducts, &c. It also involves much greater risk to passengers, by the great space taken to check the momentum and bring the train under the control of the breaks in case of sudden stoppage. And the slower the movement the larger must be the amount of stock.

With light trains all these conditions are reversed. A small station and a small number of servants, constantly occupied, will do the whole of the work; and thus a comparatively small outlay of capital is required, and a smaller amount of wages has to be struck off the general receipts.

With light trains the momentum is lessened, and less power is required both to stop and start. In case of impending collision, the risk in case of shock is lessened, and the space required to bring up in is comparatively small—50 to 60 yards would probably be enough. The small engine we have been describing will bring up from speed in about 50 yards.

Rails and roadway of far lighter structure will suffice for light trains—so much lighter as to seem almost an imputation on our "heavy-coach" railway makers. Yet, after all, the error they have committed has been in making their rails too light for their loads, and thus wasting engine power. And the greater the speed the smaller the amount of stock.

All this is to be accomplished, not by running trains on railways, or steam-carriages on highways, but by runinng *steam-carriages on railways*; in other words, by putting the load on the engine, instead of drawing it behind or propelling it before; thus increasing the adhesion of the driving-wheels in proportion to the increase of the load—getting rid of a large amount of dead weight on the wheels and carriages usually driven behind. And such light engines may have their adhesive power still further increased by a single carriage propelled before or driven behind, making such carriages rest a portion of their weight on the engine frame.

If we be told that such steam carriages do not yet exist, we can but refer to the practical demonstration of the engine already built, and state that we have now before us a practical tender, from persons fully competent to carry the plan into action, to furnish steam-carriages, rails, and timber-work ready for use, provided the land be delivered levelled and ballasted, ready for the permanent way, at the price of Two thousand pounds per mile of single way, the carriage to travel 50 miles per hour, and carry 1,000 persons per day of twelve hours, over a line of twenty miles in length, with greater safety than by the present system. The railway may be laid in ballast, or carried on piles.

On reverting to our description of the present engine, it will be seen that the gravity is chiefly below the axles and within the base of the wheels. Only those who are familiar with engines and wheel-carriages can fully estimate the importance of the principle here involved. With a pendulum-balance the weight is always seeking to be vertical. With a prop-balance the weight is always seeking to deviate from the vertical line. With a carriage moved by external power the adhesion of the wheels is lessened and increased from one to another by oscillation, and this while increasing the risk and light draught. With an internally-moved carriage, adhesion is required for the purpose of propulsion, and the pendulum action is the best adapted for it, as well as for safety. In short, the same qualities are required in a locomotive engine as in a ship, to ensure steadiness and swiftness,—"a low and a long hull."

The engine about to be constructed will have its frame not more than nine inches from the rails, all four wheels drivers, and will carry twenty or thirty passengers, as may be preferred.

The railways we have been describing may be laid either on piles, over fields, or on river banks, or on the surface of existing highways, inasmuch as the steam-carriages will ascend inclines of one in fifty, or pass round curves of two hundred feet radius with great facility. The weight of the engine will be about 2½ tons, that of the passengers about the same, making up altogether 5 tons, or 1¼ tons per wheel. Supposing it desirable to convert such engines to goods traffic, a wagon of five tons might be applied before and behind, pressing on the engine to increase the adhesion with a reduced speed. By this system, the old highways might be brought back to their former state of prosperity, and property along their borders actually increased in value.

Do railway owners see in this any deterioration of their property? We do not. If it be so, do they think they can keep it back when once shown to be a public advantage? Do they think the landholders, who were strong enough to dictate terms to railway makers for their own benefit, and drive them away from the vicinity of the old highways—do they think they will be less powerful to intermarry their highways with railways—to make railways over their land, when they are brought within the compass of their own means? We do not.

But railway men need not fear the result. The railways will ever have the same advantage over the highways that they ever have had, in better gradients and straighter lines; and they have, moreover, a source of profit that they have never yet looked to—the capability of making four lines of rail complete, with the exception of tunnels, road bridges, and stations. For the light engines and mode of transit we have been describing, the slopes and embankments are perfectly eligible. For example, in the outer fence of the railway, which is to be made sufficiently strong for the purpose, an edge timber is to be laid, and on that a light rail. A similar rail is to be laid on the embankment, and the two connected by the rails. The level of the rails is about a foot below the main rails. In cuttings, the reverse mode must be adopted, with the rails about a foot above the main rails. To wide bridges, a light wooden frame may be used. At tunnels, in vertical chalk or rock cuttings, at stations, and at level road bridges, points must be made for the main line. With light engines, capable of sixty miles speed, this would be no serious objection. With the main lines thus relieved of the fast-train passenger traffic, a much larger amount of goods and slow passengers might be carried. It is not on the Eastern Counties line, from which railway improvements have of late so largely emanated that these considerations will be lost sight of, and the Directors have done well and wisely to foster the mechanical aptitude amongst their officers for the production of railway improvements, that must tell most beneficially on their shareholders' pockets.

The amount of good that must result from this new system of railway transit, wherein the proportion of dead weight per passenger, at increased speed, is reduced from about 9 cwt. to 1¼, must be enormous. And to be achieved at the rate of £2,000 per mile, minus land and levelling! We have only regarded the question in the aspect of rapid passenger transit, but if the speed be reduced, the power becomes available for larger loads. We see in this system a means of effecting transit even in the wildest countries—a means of crossing the Isthmuses of Suez and Darien, even by individual capitalists—a means of penetrating to the southern point of Italy, and shortening sea transit without coming to England for capital—a means of regenerating Spain and making it a nation, instead of a bundle of quarrelling provinces—a means of instructing all the innumerable branches of the main lines of railway already constructed throughout Europe—a means whereby almost any individual landholder may make his own railways through his estates, and thus achieve a system of agriculture of threefold produce—a means whereby Ireland may easily be intersected and civilised, and the reproach taken away from us, that a wild people, knowing no law but the "wild justice of revenge," still dwells within the borders of our island domain.

The principle herein enunciated is that of inducing adhesion and propulsion by the agency of the load on a self-moving machine, in opposition to that of making an enormous machine to produce its own adhesion, independently of the load, and therefore requiring a machine always of the maximum weight, even with a minimum load.

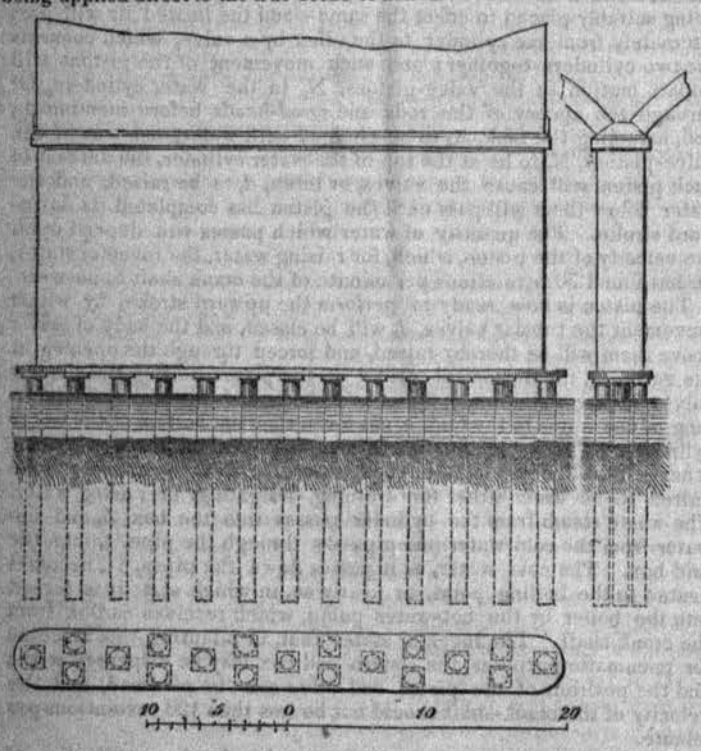
We invite our readers, who may be interested in this branch of science to investigate the data as patiently as we have done. The proposition to carry a first-class load of passengers on a self-contained machine, weighing only half the weight of an ordinary first-class carriage, and at a greatly increased speed, is a matter deeply touching the welfare of all who are connected with railways. We shall return to this important question at a future opportunity.

Photography.—M. Niepce de St. Victor, in making some experiments in photography, finds that if a sheet of paper on which there be writing or printed characters or a drawing be exposed for a few minutes to the vapour of iodine, and there be applied immediately afterwards a coating of starch moistened by slightly acidulated water, a faithful tracing of the writing, printing, or drawing will be obtained. M. Niepce has also discovered that a great number of substances, such as nitric acid, phosphoric acid, chlorurets of lime and mercury, &c., act in a similar manner, and that various vapours, particularly those of ammonia, have the effect of vivifying the images that are obtained by photography.

PNEUMATIC PILE-DRIVING.

Pile-driving is a process of great importance to the hydraulic engineer, and the means of facilitating it have engaged the attention of many. To drive by the common monkey is a clumsy operation, because the power is brought to bear on the substance of the pile rather than on the soil in which it is to be driven, and because the depth to which a pile can be driven is limited by the length of timber of which piles can be made. The effective power brought to bear has been increased by the American and other steam pile-driving machines, but without materially reducing their cost. Within the last two years a new process, called Dr. Potts's, has been introduced, which has been already applied by Mr. Robert Stephenson and other eminent engineers.

Although Dr. Potts's process is very simple, it is so different in its effects from what is imagined, that it is necessary to speak of it rather fully, in order to give a precise idea to those who, by forming quick preconceptions, may miss the principle. We have already intimated that in the common solid timber pile, power is applied to the head of the pile, and not directly to its base, or the soil into which it is to be driven, whereas Dr. Potts's pile is hollow, and the power is brought to bear immediately on the soil in which the pile is to be fixed. This is done by making the pile hollow, by exhausting the air from it, and so drawing up the soil from below the pile, whereby it is made to sink. The pile is not driven down, as most would think, by the sole pressure of the atmosphere on the top of the pile, but the shingle, gravel, or sand being removed into the pile as the air is exhausted, the soil is constantly excavated beneath the bottom of the pile, and driving and excavating proceed at the same time. This we look upon as the real distinction between the old and new process, and the point in favour of the latter, while the power is further economised by being applied direct to the true scene of action.



Our engraving represents the pier supported on pneumatic piles, laid down by Mr. Robert Stephenson on the Chester and Holyhead railway in the course of this summer, being one among the many novel and curious works on that great public undertaking, and illustrating the enterprise of its eminent engineer. The viaduct is skew, and is carried over a branch of the sea, in the island of Anglesey, and consists of two land piers built in the usual way, and of this centre pier, laid on a sand bank. It is 36 feet long and 3 feet wide, and is built on 19 cast-iron tubes, each 16 feet long and 1 foot diameter. The tubes were sunk by means of a small double air-pump, with cylinders 4½ inches diameter, and 16 inches length of stroke, worked by four men; the pumps were placed on the land pier, and a half-inch lead pipe was carried from the pumps on to the water at the place of driving.

Each tube was placed perpendicular over the spot on which it was to be sunk, and then a square iron cap placed on the top, with the half-inch leaden tube just described passing through it; at every stroke of the pump the air was exhausted from withinside of the tube, and as the exhausting process proceeded, the pile or tube made its way downwards, and the soil displaced at the bottom passed into the lower part of the tube,—and thus the operation was continued until the pile was sunk to the required depth When the whole of the nineteen piles were sunk to one level, as shown in the annexed engraving, a cast-iron plate, weighing 9 tons, was placed over them, just on a level above the surface of the water, and formed the foundation upon which the superstructure was built.

The pumps were brought down by coach, put together, worked, unshipped, and sent back again, all within a few days, so that nothing cumbrous in the way of apparatus is involved in the application—and, indeed, the air-pump can be carried where the pile-driving machine cannot. The piles were driven at the rate of half-a-minute per foot for the first six feet, and at about three minutes to the foot for the remainder.

The arches are 20 feet wide on the square, and 26 feet on the skew; and the piers 3 feet wide on the square, and 3 ft. 10 in. on the skew.

In July 1845, a pile of cast-iron, of 2 ft. 6 in. diameter, was driven into the Goodwin Sands by the engineers of the Trinity House. The rise of the tide and the state of the weather prevented the uninterrupted progress of the work, and it was unavoidably divided into three separate periods, which gave the following results:—

July 19	in 3 hours,	driven 22 ft.	0 in.
„ 21	1 „	„ 10	0
„ 26	1½ „	„ 1	7

The total depth driven below the surface of the sand was therefore 33 ft. 7 in. This is only one of many experiments performed by the Trinity Board, who have a license for the application of the patent, and have used it in many of their smaller works.

In the autumn of this year, the Trinity Board erected a beacon, by the pneumatic process, on the South Calliper of the Goodwin Sands—a very dangerous spot. The centre column is a tube of cast-iron, 2 ft. 6 in. diameter, put together in 10 and 20 feet lengths, and inserted 32 feet deep in the sand. Around it are four other cast-iron tubes, each of 15 inches diameter, the whole braced together, and supporting a cage on the top, which is 56 feet above the sand level. In the great storm in October, this work was broken; but this failure had nothing to do with the pile-driving process, which was efficiently carried out, the piles being driven 32 feet,—whereas, in Admiral Beaufort's experiments on the Goodwin, he could only drive a steel bar 8 feet with a sledge hammer; and Captain Bullock, R.N., found that a pointed iron rod of 3 inches diameter, when driven 13 feet in the same sands, took 46 blows of a monkey weighing 1 cwt., and with a 10 feet fall, to drive it one inch. It should be observed, the beacon on the Goodwin was of cast-iron only.

Dr. Potts's plan allows the application of cast-iron tubes of any diameter and any length, whereas wood pile-driving is limited by the scantling of the timber, and timber piles of a large scanting are very expensive. Two feet six inches, used on the Goodwin, is an unexampled diameter for a pile, but there are no such narrow limits to the new process. Metal or wood may be used for the tubes, and they may be made of staves hooped. The patentee offers to put down small fishing and bathing-houses and stations in the sands, at very moderate rates, and the plan is likely to be applied for columns for carrying electric telegraphs over rivers, and for piers or towers of suspension bridges.

It should be noticed that a cylindrical tube, placed vertically on a body, of sand and water, cannot be made to descend without great pressure, and then only a few inches; but by exhausting the air from the tube and drawing up the soil from the bottom it sinks most rapidly.

It is found in practice that not merely will sand, shingle, mud, bog, and clay be carried up the pile, but even large stones are carried in suspension, so that every kind of soil can be mastered except rock—and there it is not wanted, because there is a solid foundation.

The hydraulic engineer will at once appreciate the utility of this invention for river and sea-walls, piers, and breakwaters; but its applications are very numerous, and, as it can be most economically used, it will lead to many new classes of works, for it extends the range of engineering. Mr. Alexander Gordon, in laying down one of his new colonial lighthouses, proposes the application of this plan, of the practicability of which he speaks from experience, and in a paper published by him on the subject, he writes warmly in favour of trying it in other situations. Mr. Robert Stephenson has, however, been the first to apply the plan on any considerable scale, though what has been done hitherto by all parties is far from enough to make it generally known among the profession. Those of our

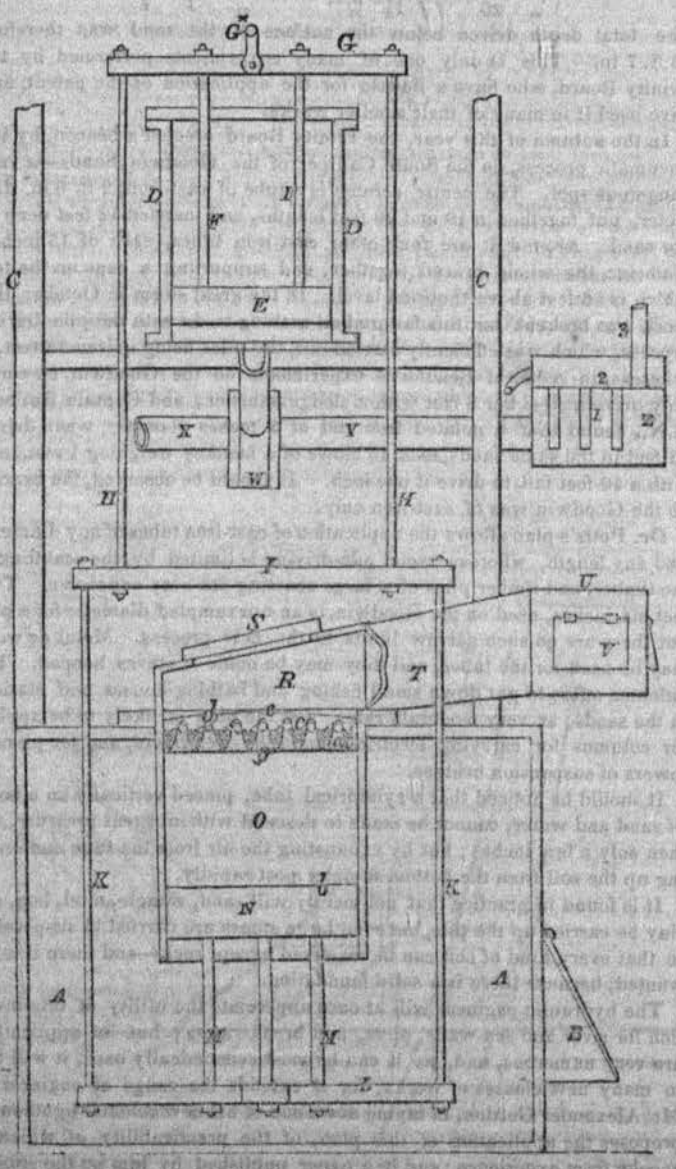
readers who feel an interest in seeing the plan in working, should visit what may be called the museum of the patentee, at No. 9, Buckingham-street, Strand, where a great many models have been exhibited and experiments made, and which are really deserving of inspection by professional men, especially those practically engaged, as so many are, in hydraulic engineering.

REGISTER OF NEW PATENTS.

HYDRAULIC AND PNEUMATIC MACHINERY.

JOHN WALKER, of Crooked-lane, London, for "*Improvements in certain hydraulic and pneumatic machinery, and in the application of steam or other powers thereto.*"—Granted April 20; Enrolled October 20, 1847. [Reported in the *Mining Journal*.]

This invention, which is comprised under two heads, consists of the following arrangements and combinations of parts—the first is as follows:—In the accompanying drawing, A A, marks a metal tank, having three sluice-doors B, covering openings therein, either of which may be covered or uncovered at pleasure. Such tank is supported by a strong framing of wood, and upon the top of this tank are strong metal framings, C, which support and carry the several working parts



of the machine, of which D D marks a steam cylinder, and there are two, placed side by side, fitted with suitable pistons, E, and piston-rods, F; to the upper part of these piston-rods, a cross-head, G, is attached, from each end of which there depend two rods, H H—the lower ends whereof are attached to a cross-head, I, from which there depends, in a similar manner to the cross-head, G, two rods, K; the lower ends of the last-mentioned rods are securely fixed to a cruciform-shaped piece, L, to which piece there are fixed four rods, M with their upper extremities attached to a valve-piston, N, of peculiar construction, hereafter mentioned and exhibited in transverse and vertical section. O, marks a water cylinder; there being two of them placed side by side, and fixed to the framing, P, as is the case with the steam cylinders, D D. The water cylinders, O O, are furnished at their upper ends with valves, Q, similar in construction to those in the pistons, N; and such valves are arranged and combined as follows:—*a* marks a grating, upon the outer edge of which there is shrunk a wrought-ring, *b*; and the lower edges of the bars, *c*, which form this grating, are made wider than the upper part, or seat, for the valves, *d*, to allow the water to pass freely—such valves being composed of metal tubes, plugged with wood; and they have free liberty of vertical movement, and are guided in their proper course by cross pieces *e*, which embrace their ends; and immediately above the valves, Q, which are fixed at the tops of the cylinders, O, there is a box, R, furnished with a cover, S, over each valve; and to this box is attached a pipe, T, which terminates in a box, U, having three clacks, or sluice-doors, V, which can be opened or closed at pleasure. W marks a slide for regulating the admission of steam through the pipe, X, to the two cylinders, D D, alternately. Y, the eduction pipe, to which is attached a rectangular-shaped box, Z, arranged in the following manner:—1 1 mark a series of pipes, which extend to within a short distance of the bottom of the box, Z—the upper ends of such pipes being fixed in a partition-plate, 2, as also is the eduction pipe, 3. The operations of this machine are as follows:—Steam, of the pressure of about 25 lb. to the square inch, being admitted to the under side of one or other of the pistons, E, will cause it to ascend, and thereby impart motion to a crank-shaft, through the medium of a connecting-rod, G, and the upward movement of one piston will cause the downward movement of the other—the cranks upon the shaft being suitably placed to effect the same—and the heated air will pass alternately from one cylinder to the other by a valve, which connects the two cylinders together; and such movement of the pistons will impart motion to the valve-pistons, N, in the water cylinders, O' through the agency of the rods and cross-heads before mentioned; and, assuming the tank, A, to be charged with water, and one of the valve-pistons, N, to be at the top of the water cylinder, the descent of such piston will cause the valves, or tubes, *d*, to be raised, and the water below them will pass until the piston has completed its downward stroke. The quantity of water which passes will depend upon the velocity of the piston, which, for raising water, the inventor states, he has found 70 revolutions per minute of the crank shaft to answer.

The piston is now ready to perform the upward stroke, by which movement the tubular valves, *d*, will be closed, and the body of water above them will be thereby raised, and forced through the opening in the valve, Q, the downward stroke of the piston causing the tubular valves in the valve-seats, Q, to be closed; and this will continue so long as the water in the tank is not lower than the bottom of the water cylinders. The water thus raised may be passed off through one or other of the sluice-doors in the box, according as the machinery is required to be used either for draining, irrigating, or raising water. The waste steam from the cylinder passes into the box, Z, and the water from the cold-water pump passes through the pipe, 4, into the said box. The cold water, as it passes down the pipes, 11, becomes heated to the boiling point, or nearly so, in which state it is forced into the boiler by the hot-water pump, which receives motion from the crank-shaft. The inventor states that, in adapting this machine for pneumatic purposes, the cistern and box may be dispensed with; and the position of the piston and valve must be reversed, and the velocity of the crank-shaft should not be less than 120 revolutions per minute.

The second part of this invention consists in the application of vanes, mounted upon a spindle in sets, each set being placed in an opposite direction to the other. The inventor states that, although he has used flat vanes, he does not confine himself to them, as, in some instances, he prefers using vanes forming the segment of a screw, similar to those used for propelling boats. These vanes are mounted upon each end of a spindle, the periphery of which fits into a short cylinder, the ends whereof being open; and such cylinder is fixed within a box or cistern, at one side whereof is a suction-pipe; and, at the top of the open cylinder, there is attached a pipe, which is the exit-pipe for the passage of water, or air. The said spindle may receive motion from manual or steam power; and the motion of the vanes in one direction will cause the water to be raised up one pipe, and a reverse movement of the vanes will raise it up the other pipe—the water, in the first instance, passing the openings between the

vanes, through the open ends of the short cylinder, and, in the latter case, passing out at the ends of the cylinder, and down the suction-pipe. The velocity of this machine, when employed for raising water, should not be less than 150 revolutions per minute; and, when employed for pneumatic purposes, about 1400 revolutions per minute.

The inventor claims the combination and arrangement set forth as constituting improvements in certain hydraulic and pneumatic machines; and secondly, the combinations and arrangement of a high-pressure engine for such purposes.

COPYING PRESSES.

WILLIAM HENRY KEMPTON, of South-street, Pentonville, gentleman, for "*Improvements in copying presses.*"—Granted March 23; Enrolled Sept. 23, 1847.

This invention consists of a copying press so arranged that the act of shutting a lid or cover acting on a bed or surface is, by the resistance of a spring or springs, caused to produce the requisite pressure for copying letters or other documents, as shown in the annexed engraving. Fig. 1 is a plan of the copying press open, and fig. 2 a sec-

Fig. 1.

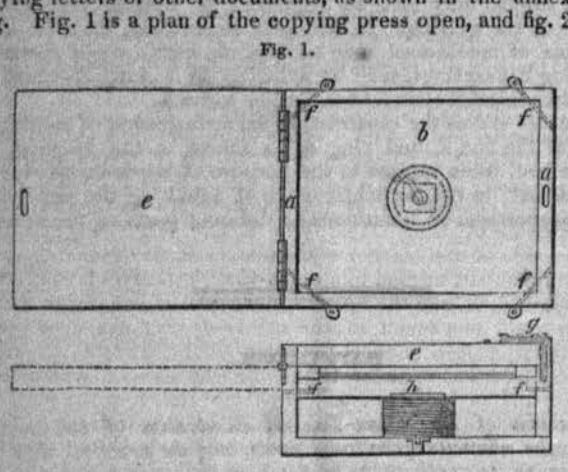


Fig. 2.

tion thereof, the lid or cover being closed. *a*, the frame; *b*, the bed, constantly pushed upwards by a spring or springs, *c*, for giving the requisite elasticity between the bed *b*, and the lid or cover *e*. *f*, stops to prevent the bed or surface, *b*, rising too high. The letter or other document with damped paper and other materials, as in other flat copying presses, are to be placed on the surface of the bed *b*, and then the act of closing the lid *e*, will cause the bed *b*, to be pressed downwards, and the lid is to be retained shut by a bolt *g*, for a short time, when the desired copyright will be obtained.

OIL-CAKE PRESSER.

JAMES ROBSON, of Dover, Kent, engineer, for "*a new and improved instrument to be used in expressing oil from vegetable and other substances, and in making oil-cake, &c.*"—Granted April 15; Enrolled Oct. 15, 1847.

When manufacturing oil-cake, it is usual to employ instruments made of horse-hair, called "hairs," for enclosing the flannel bags containing the substance to be pressed; but, in consequence of the horse-hair fabric soon becoming clogged, the patentee substitutes an instrument constructed of metal, as shown in the annexed engravings.

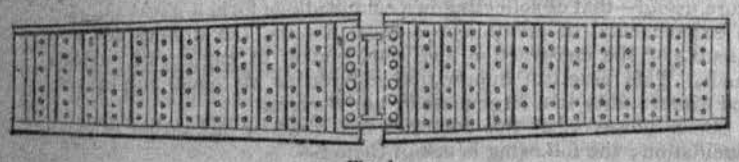


Fig. 1.

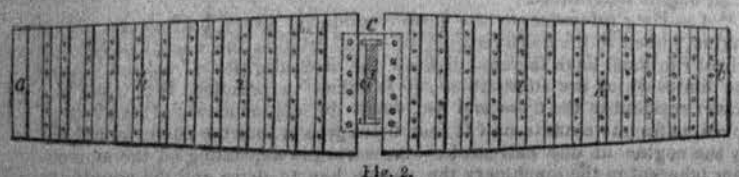


Fig. 2.

Fig. 1 is the interior view, and fig. 2 the exterior of the instrument, in an open or extended state; fig. 3 a longitudinal section, and fig. 4

Fig. 3.

Fig. 4.

a transverse section, of the instrument. *a*, *b*, are two metal plates or flaps, corresponding to those hitherto made of horse-hair cloth; but the shape may be varied. *c*, is a leather hinge, connecting the two plates; and *d*, a handle. Along the sides of the plates, and at the end of the plate *b* a rim is formed, to prevent the material from being pressed beyond the edges of the plates. Across the inner side of each plate, a series of ridges and depressions are made, in such a manner that when the instrument is closed, the ridges on the plate *a*, will come opposite the depressions in the plate *b*; and through the sunken portions of each plate a series of holes *h*, are formed, opening into grooves *i*, across the back of the plates: these holes may be one-sixteenth of an inch in diameter, and half an inch apart; but the patentee does not confine himself to these dimensions. The linseed or other matter to be pressed is prepared and placed between the plates, and pressed in the same way as when using a like instrument made of hair.

RAILWAY CHAIRS AND FASTENINGS.

CHARLES MAY, of Ipswich, Suffolk, civil engineer, for "*Improvements in railway chairs, the fastenings to be used therewith, and in trenails.*"—Granted March 27; Enrolled September 27, 1847.

The first part of this invention consists of improvements in manufacturing railway chairs. In performing this part of the invention the mould is formed in a similar manner to that described in Ransome and May's patent of Feb. 1841, in which side plates of metal are used to form part of the mould and for guiding the core. This part of the invention consists of forming the core for the interior of the jaw of a chair, with sand upon a metal interior, or core-bar, combined with the using of metal side-plates or surfaces as part of a mould, and as supports to the core. This part of the invention also consists of having a cross-bar attached to the flask, into which the tail-end of the core projects. And further, it consists of using metal cores for casting the holes for the trenails or fastenings.

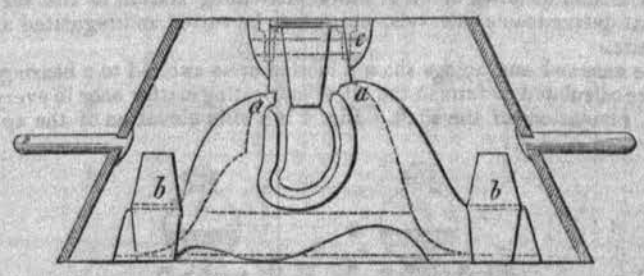


Fig. 1.

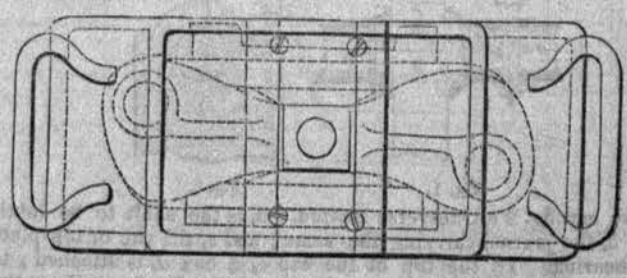


Fig. 2.

Fig. 1, shows a longitudinal section; fig. 2, a plan of a flask, with a sand-mould representing a chair cast on to a core, the top side of the mould being removed. To produce a clean or chill surface in certain parts of the chair, the iron part of the core is left to come in contact with the melted metal, as is shown at *a*, fig. 1; the extent and portion of this clean or chill surface may be varied. To produce clean or chill holes for the trenails, the metal cores at *b*, *b*, are used; *c*, is a

cross-bar fixed across the flask, so as to receive the tail-end of the core in such manner as to ensure its correct placing and holding when in the sand-mould, which cross-bar will be found advantageous (when casting railway chairs) for holding the core used, whether employed separately or in conjunction with the side-plates shown.

The second part of the invention consists in so arranging apparatus that a rammer, or rammers, worked by mechanical power, may be employed in ramming the sand into a core-box, so as to make suitable cores for casting railway chairs.

The third improvement relates to combining a process for preserving the wood used for fastenings of railway chairs and trenails with the process of compression, that for preserving the wood being first performed, and then the compression:—Take the heavy oil of coal-tar, called creosote, and pass through it, in a close vessel, a stream of steam from a boiler capable of sustaining from 80 to 100 lb. pressure; the pieces of wood prepared for the trenails or wedges are placed in a vessel also of great strength, and the combined vapour of water and creosote allowed to act upon them for some time (half an hour to an hour); this combined vapour penetrates the wood effectually, and when it is desirable to combine more of the creosote with the wood, it is subjected to the vapour of creosote only, without the vapour of water. The patentee states that such modes of impregnating wood with preservative matter is not claimed by him, the same being old and well known. The process of compression is to be performed (when the wood is dry) as described in the said former specification.

The fourth improvement relates to the manufacture of wood fastenings used with railway chairs, and of wood trenails. In practice, such fastenings as are described under the said former patent are liable to exposure to moisture before inserting them, or applying them to the purpose for which they are intended, and they thus frequently become swelled. And it has been found desirable to retard this swelling process, which the patentee accomplishes by covering with any repellant of water, as varnish or grease; but it is not intended that this shall permanently repel moisture, as they are required to swell after driving. It has been found that a thin solution of common resin in oil of turpentine answers very well, which is used as a coating to such fastenings as soon as they are made.

LUBRICATOR FOR MACHINERY.

James Carter, of Oldham, Lancaster, painter, for "*an Improved lubricator.*"—Granted Dec. 14, 1846; Enrolled June 14, 1847. [Reported in *Newton's London Journal.*]

This improved lubricator is for lubricating shafts, bearings, axles, and working surfaces of machinery generally, and is intended to furnish a certain quantity of oil or other lubricating matter to the surfaces at determinable intervals, which may be varied and regulated at pleasure.

The annexed engravings show a lubricator as applied to a bearing, and are calculated to furnish the oil or lubricating matter once in every 5,200 revolutions of the shaft. Fig. 1 is a side elevation of the apparatus; and fig. 2 a transverse section. *a*, is the shaft to be lubricated; *b*, the journal carrying the same; and *c*, the cap or top-plate of the bearing. To the top of the cap *c*, a box *d*, is attached; to which is fixed a bracket *e*, for carrying the shafts *f*, and *g*. Upon the shaft *a*, is keyed a worm *h*, which is cast in two pieces (for the convenience of fixing on the shaft), and fastened together with small screws. This worm actuates a worm-wheel *i*, of twenty teeth, keyed to one end of the shaft *f*, which, at its other end, carries a worm *j*, in gear with a worm-wheel *k*, also of twenty teeth, keyed to the shaft *g*, which also carries a worm *l*, for driving a worm-wheel *m*, having twenty-seven teeth. This wheel *m*, is fixed at the upper end of a hollow plug *n*, which is ground true, and revolves in the box *d*. To the top of this hollow plug *n*, is fixed the cup or vessel *o*, which contains the lubricating matter. The plug *n*, is open at top and bottom, and has two openings, *p* and *q*, one at each side; it is also provided with a midfeather, extending above the opening *p*, and below the opening *q*. As the plug *n*, revolves, the opening *q*, coming opposite to the screw *r*, allows the oil to fill the space between the plug and the end of the screw *r*. The revolution of the plug then brings the opening *p*, opposite the screw *r*, and allows the oil left in the space between the screw and plug to pass through the lower part of the plug *n*, on to the shaft *a*; at the same time the opening *q*, comes opposite to the screw *s*, and fills the space between the end of the same and the plug *n*. Thus it will be seen, that the quantity of oil left in the spaces at the ends of the screws *r* and *s*, is furnished to the shaft *a*, twice in each revolution of the plug *n*; and as the wheel *m* has twenty-seven teeth, and the wheels *i* and *k* have each twenty teeth, then $20 \times 20 \times 27 = 10400$; therefore, the oil is furnished twice in 10,400 revolutions of the shaft *a*, or, as above stated, once in 5,200 revolutions. It will of course be evident that the quantity of oil may be regulated by means of the screws *r* and *s*; and the intervals between each supply may also be regulated by altering the relative proportions of the gearing. It will also be evident, that the same arrangements of mechanism may be applied, with a slight variation, to lubricating flat surfaces, such as substituting a ratchet-wheel and click, or other suitable contrivance, for the worm *h*.

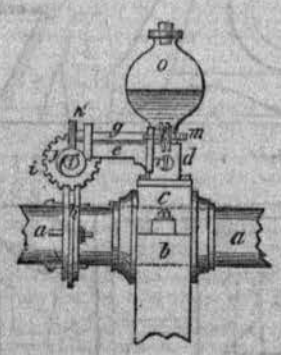


Fig. 1.

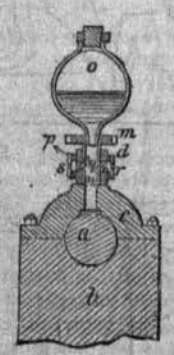


Fig. 2.

The patentee claims the construction and arrangement of mechanism consisting of the box *d*, and plug *n*, as shown in the drawing, and above described, when applied to the purpose of lubricating; without confining himself to the particular mode of actuating the same, or to the exact proportions or dimensions of different parts of the same.

REVIEWS.

A Catechism of the Steam-Engine, illustrative of the scientific principles upon which its operation depends, and the practical details of its structure, in its applications to mines, mills, steam navigation, and railways, with various suggestions of improvement. By John Bourne, C.E. London: Williams, 1847. 12mo. pp. 276.

Mr. Bourne is already known as the editor of a quarto treatise on the steam-engine, published in parts, and bearing the name of the "Artizan Club." The present work has much the same merits and defects as its predecessor—it displays, on the one hand, the same diligence and care in collecting important facts and original experimental information; on the other, it displays the same want of care and diligence in arranging these valuable materials. This "catechism" is not, as far as we have been able to discern, arranged on any definite plan, and the order of the various topics has apparently been left to chance. This, however, is not a *very* great disadvantage in a work dealing principally with facts, and not professing the character of a systematic exposition of the general theory of the steam-engine. The scientific principles are, for the most part, tolerably accurate, but they are scattered up and down the book—not connected by a logical chain of reasoning, of which every single link is necessary for the continuity of the whole. It may even be doubted whether the construction of such a chain be yet possible—whether we yet possess body of facts respecting the operation of the steam-engine sufficiently copious and precise to permit their reduction to one general code of laws. Mr. Bourne has not attempted here this perilous enterprise, but has accomplished a task less ambitious, but far more useful—that of collecting in a compendious form a great number of experimental observations, practical details, and dimensions and minutiæ of the construction and management of engines of various kinds. This practical information will render his book one of real and direct utility to a large class of our readers.

Some, however, of the doctrines laid down by our author require elucidation; the following is one of them:—

"*Q.*—By what considerations is the momentum proper for the fly-wheel of an engine determined?

"*A.*—By a reference to the power produced every half stroke of the engine, joined to the consideration of what relation the energy of the fly-wheel rim must have thereto, to keep the irregularities of motion within the limits which are admissible. It is found in practice, that when the power resident in the fly-wheel rim, when the engine moves at its average speed, is from two-and-a-half to four times greater than the power generated by the engine in one half-stroke—the variation depending on the momentum inherent in the machinery the engine has to drive and the equability

of motion required—the engine will work with sufficient regularity for all ordinary purposes."

The last paragraph is rendered ambiguous by the vague use of the word "power." The "power resident in the fly-wheel," we presume to mean its *vis viva*, or mass multiplied by the square of its velocity—in fact, there can be no other measure of the *power* of a fly-wheel. The "power generated by the engine in one half-stroke," probably signifies "work done," or the pressure on the piston multiplied by the distance through which it acts. Thus "work done" is always equivalent to a determinate amount of *vis viva*; that is, if it acted on a body or bodies subject to no prejudicial resistances, would produce a certain calculable velocity, such that the *vis viva* would be the same, whether the mass acted on were small or great. Consequently, Mr. Bourne's rule may be stated thus:—when the engine is in its normal state of working, the *vis viva* of the fly-wheel must be two-and-a-half to four times greater than the *vis viva* which the engine would produce during a half-stroke. For example, if the mass of the fly-wheel (supposed to be collected at its rim) were M, and V the linear velocity with which it generally moved, $M V^2$ would be its actual *vis viva*. Suppose that if the engine could act on the fly-wheel *exclusively* for a half-stroke, the velocity generated would be v; the corresponding hypothetical *vis viva* would be $M v^2$; and adopting the highest of Mr. Bourne's ratios, we should have

$$4 M V^2 = M v^2, \text{ or } 2 V = v,$$

which would reduce the rule to a simpler form, as follows:—the mass of the fly-wheel must be so chosen, that the velocity which the engine *would* produce in it by acting on it exclusively for half a stroke may be half its actual velocity when the engine is in its ordinary state of working.

We have endeavoured to develope the rule in the above manner, not from its intrinsic value, but merely to illustrate the extreme importance of adhering, in all mechanical disquisitions, to measures of force about which there cannot be any possible ambiguity. The use of vague phrases to indicate the various effect of forces is the true cause of the difficulty of the subject. If a precise, systematic nomenclature were universally understood and adopted, there would be far fewer of the idle discussions of principles with which we and our contemporaries are bored, and far less money would be spent in securing by patent the exclusive right of effecting impossibilities.

With respect, however, to the intrinsic value of the above rule respecting the fly-wheel, it is to be observed that it can only apply to engines performing a particular class of duties. The duties may task the engine in such an equable and uniform manner, that no fly-wheel need be required. Or, again, the resistances may be capable of such great fluctuations, that a fly-wheel of enormous dimensions may be required. The *variation of resistances* is not taken into account in Mr. Bourne's rule. A fly-wheel is a kind of bank in which force is treasured up in times of abundance, to be redistributed in times of scarcity. The greater the superabundance at one period, and deficiency at another, the greater must be the capacity of the bank.

Another doctrine adopted in this treatise, and which seems liable to lead to erroneous conclusions, is the following:—

"Setting aside loss from friction, and supposing the vacuum to be a perfect one, there would be no benefit arising from the use of steam of a high pressure in condensing engines, for the same weight of steam used without expansion, or with the same measure of expansion, would produce at every pressure the same amount of mechanical power. A piston, with a square foot of area, and a stroke of three feet with a pressure of one atmosphere, would obviously lift the same weight through the same distance, as a cylinder with half a square foot of area, a stroke of three feet, and a pressure of two atmospheres. In the one case, we have three cubic feet of steam of the pressure of one atmosphere, and in the other case 1½ cubic feet of the pressure of two atmospheres. But there is the same weight of steam, or the same quantity of heat and water in it, in both cases, so that it appears a given weight of steam would, under such circumstances, produce a definite amount of power, without reference to the pressure."

This reasoning seems to overlook the gain of mechanical effect resulting from the employment of very high-pressure steam used with a great degree of expansion. Theoretically, the higher the steam-pressure, the greater will (by working expansively) be the power obtained from a given quantity of fuel. It may be assumed that a pound of coke or coal will evaporate the same quantity of water at any pressure. The steam produced, therefore, will, while acting at full pressure, or unexpansively, effect the same amount of work in both cases. But when the steam is cut off and expanded, more work will be *got out* of the high-pressure steam than the low-pressure; for the former may be expanded to a greater degree than the latter, before it become so weakened as to be incapable of further useful effect. The use of high-pressure steam is not so indifferent a matter as the above quotation seems to suggest. Setting aside the question of safety, the higher the pressure of the steam the greater will be the economy of fuel, supposing the expansion always carried to that point where the steam ceases to act beneficially. A mistake on this point seems to have led Mr. Bourne to say further on, that "the superior economy of the Cornish boiler is not derived from any peculiarity of form and arrangement, but from the immense extension of heating surface."

In treating of the resistance to the motion of railway trains, Mr. Bourne falls into the common error of assuming that the rapid increase of resistance resulting from the increase of velocity is due to the action of the air. This resistance is only one item in the calculation, and is often (we are inclined to think) a very small one. The deflection and vibration of the rails, concussions at their joints, strains from the wheels or axles being slightly twisted, and the thousand-and-one jolts, jars, rattlings, and vibrations inseparable from rapid motion absorb the greater part of the power required at high velocities.

In alluding to one or two deficiencies in the present treatise, we would by no means have it inferred that they are samples of the whole book. On the contrary, the information conveyed seems generally very trustworthy, and it has the advantage of being communicated in an intelligent manner. Had we space to dilate on the chief merits of this work, we might have chosen numerous texts for the purpose—among others, the excellent account of the present state of knowledge respecting the performance of marine screw-propellers, and the clear descriptions given of various details of the mechanism of locomotive engines.

A History of the Architecture of the Abbey Church of St. Alban, with especial Reference to the Norman Structure. By J. C. BUCKLER and C. A. BUCKLER. London: Longmans, 1847.

We had hoped to have had more space for our notice of the valuable work of Messrs. Buckler, but we find that with the close of our volume, we have too many subjects claiming our attention, and yet we do not like to delay what is an act of justice towards the authors. We cannot but feel that the design of the work, that of giving a complete account of the Norman architecture of the Abbey at St. Alban's, is highly praiseworthy, and is carried out in a conscientious spirit of labour. The history of Matthew Paris has been particularly valuable to the authors, and they have made very good use of it, the old monkish annalist having shown an earnest desire to commemorate everything of interest in connexion with the building and its abbots. He lived, too, at a time when the most important works were carried on for its adornment, and we can hardly help wishing he had given us still more information as to details, though really we owe him, as it is, a large debt for what he has so copiously recorded.

By a careful collation of such records with the present building, Messrs. Buckler have been able to reproduce the old Norman structure, and to give us a lively picture of such a building in its pristine and palmy state. This makes the work, what naturalists would call a monograph—a well described account of a fine specimen, and is therefore very useful to practical men, who have occasion to study or apply the Norman style.

The Norman abbey church is one of the first class as to size, for its length from east to west was 440 feet, forming a long Latin cross, and having a transept of 176 feet in length, and a lofty lantern tower in the choir. The long nave of thirteen bays may be considered one of the grandest parts of the structure, though perhaps the breadth was too small for the vast length. The authors remark that particular regard seems to have been paid to laying out the plan of the church, and fixing the positions of the piers. Measurement has proved the extreme accuracy of this part of the work. There is not, however, such comformity in the superficies of the walls and pilasters, and their retreating members, though the appearance of the building generally is correct. When we consider the imperfect organization of labour and machinery in those days, the merit is very great.

The materials employed being chiefly from the remains of the Roman city of Verulamium, give a peculiar character to the building, and the more particularly as the want of stone in the neighbourhood led to the use of cement as a covering in some places. Where this has been stripped off, the appearance of the building is much injured; but it has enabled Messrs. Buckler to give many interesting drawings illustrative of the details of construction.

It is noticed that the upright line of the walls is preserved throughout their height, which measures 68 feet 3 inches from the original pavement in the nave. There is, however, a deviation in the exterior of the lantern tower, which has pyramidal sides up to the belfry stage, above which they are perpendicular, while the contignation is arraigned as being abrupt, and not altogether pleasing.

One peculiarity pointed out is that the remaining abutment piers on the exterior of the upper wall of the south aisle take their places beyond the lines of those below, and are based on the brick vaulting with perfect security. The reason of this is not explained, nor is it obvious.

Messrs. Buckler have observed that many of the smaller arches in the building are irregularly curved, and indeed distorted. This is not uncommon in Norman buildings of elaborate design and costly material, and is supposed to arise in some cases from the arches being turned over the openings without the help of wooden centrings, or with rough frames.

In this church the system is fully seen which was adopted by the Norman architects of building walls across all the openings, so as to tie the whole of the work together for greater security. The extent of this underground work as discovered by Messrs. Buckler within the eastern aisle is said to be truly astonishing. The system was sometimes imitated by the architects who made additions to the building.

Of the columns of the nave it is remarked that there is far less bulk and appearance of casing than in those of Winchester cathedral, as greater dependence could be placed upon the strength of the brick-work core, than upon that of rubble-work.

The west front was 155 feet in its extreme breadth, being flanked by two lofty towers, measuring 40 feet in the square on the outside, and being planted on massive stone and brick foundations.

With an opinion of the authors, in reference to another subject, we cannot but concur. They observe that in Herefordshire, the greater number of church towers are characterised by slender spires, constructed of timber and covered with lead. They regret that these should ever be removed, as they so often are for the value of the lead. Though the spires may be less ancient than the towers, their age is still great, and their destruction cannot but be considered an act of barbarism.

In conclusion, we cordially recommend this work to the libraries of our readers, to whom its moderate size and price offer an additional inducement.

An Easy Introduction to Railway Mensuration. By E. V. Gardner, C.E. London: Weale, 1847.

The idea of this book is a good one, and, once conceived, it was easy for Mr. Gardner to carry it out; while as a special work, it is likely to pay well. It consists chiefly of working plans and forms from the Brighton Railway, the South Western, the Farnham and Alton, Syston and Peterborough, and Salisbury Branch Extension Railways. The book is therefore practical enough, and, by having a number of ruled pages, can be studied and worked up at the same time.

Among the illustrations are a specification, small barrel culverts, large culverts with wing walls, open culverts, bridge, occupation road, occupation bridge, skew bridge, viaduct, timber viaduct, another with iron tension-rods, &c. There are likewise plans and sections with curves set out, off-sets for unsoiling, outside fencing, and ditches, &c. Mr. Gardner says enough about tunnelling to enable the student to understand the mode of mensuration, and how to set off the ranging line from above to below. Full directions are given as to the measurement of cuttings and embankments.

Mr. Gardner recommends that the number of parts measured should always be placed first, to prevent error of quantity, such as occurred a few years since in the erection of a new church a few miles from London, where the gallery was measured and not twiced, thus leaving one gallery wholly out of the quantities, which could hardly have happeded had the No. 2 been placed first. In all cases, even in cubing the dimensions given for practice, Mr. Gardner urges that every dimension should be checked, to prevent error; and before beginning to measure, to well study and understand the plan.

We think the work will be found useful by the parties for whom it is designed.

Plane and Spherical Trigonometry. Part I. containing rules, examples, and problems. Part II. containing the principal formulæ, with exercises and examples; the proofs of the rules in logarithms and trigonometry, and the construction of logarithmic tables. By H. W. Jeans, F.R.A.S., Royal Naval College. London: Longmans, 1847. 2 vols. pp. 124 each. 12mo.

The first of these little volumes contains a collection of rules for applying logarithms to geometry, navigation, &c. The second volume gives *separately* the demonstrations of the rules. This separation may be useful to those who are required to deal rather with results than principles—whose occupations render it necessary for them to obtain arithmetical results, by processes of which they are unwilling or unable to comprehend the logical accuracy. We do not much admire the learning-made-easy system; it misses all the advantages of mental discipline, and fosters mere superficial attainments. The knowledge-doctors are the professed apologists and coadjutors of shallow-headed students;—their very trade is to coat ignorance with a varnish. However, there are certain cases in which it is absolutely necessary to set people in the way of working problems without understanding the principles of them; for instance, it would appear, from the work before us, that this necessity exists at the Royal Naval College.

The rules are concisely and clearly expressed, and are accompanied by numerous examples fully worked out.

Elements of Geometry. By J. D. London: Longmans, 1847.

What the object of this pamphlet may be we cannot make out. The author introduces new and complex processes, without any preface; and he gives new definitions, which are no more definite than the old ones, and much less philosophical.

GEOLOGICAL LECTURES,

By Professor Ansted. Delivered at King's College, London—Session, 1847.

Geological Considerations affecting Agriculture.

After some prefatory observations, Professor Ansted proceeded to explain the points in which the practice of agriculture was affected by geological considerations and knowledge. They were two in number—first, that which related to *materials*, taking one of the divisions of the subject mentioned in the preceding lectures: under this head they would have to consider the nature, use, and way of modifying those materials. Secondly, considering the earth as the basis of operations, they would have to observe how agriculture was affected by the arrangement of materials; and how, by certain laws, affecting the structure of the earth, the soil might be rendered more fertile, by supplying water where needed, or by removing it by drainage when the land was flooded. Certain mineral substances were necessary for the growth of plants; and hence, if they took any of the vegetable substances in common use by man, and exposed them to a high degree of heat—thus getting rid of the carbon, oxygen, nitrogen, hydrogen, and some other elements of the plant—there always remained a residuum of ashes, which contained the mineral substances necessary in the growth of the plant consumed. If, for instance, they took any of the cereals, such as wheat, and burnt its straw, ear, and corn, they would find in the ashes which were left a considerable portion of silica; and in other plants there would be certain quantities of potash, soda, lime, and magnesia, not unfrequently a little iron, and sometimes, but not often, phosphorus. All these, then, were materials necessary for the growth of plants, and it was useful to know whether any particular spot where these plants were intended to grow, possessed the materials necessary for their health and sustenance. A knowledge of the "chemical composition" of soils was, therefore, highly important, as some of the above substances, occurring in certain proportions of the soil, might be noxious, and even poisonous, to some plants; while to others they might be indispensable. There was, in fact, no universal poison. It was also necessary to know something of the "condition" in which these constituents were present in the soil. Supposing, for instance, there were potash, soda, and phosphorus, it was well to know whether these materials possessed a greater affinity for the substances with which they were already combined than the plant was able to overcome, as, in that case, they would not benefit it; or, if those materials or constituents were free, whether they were so much separated as to render them not only useless, but noxious and mischievous. It was also exceedingly useful to know the "mechanical condition" of the soil. Plants throw out roots and rootlets, not only to imbibe nourishment from the soil, but to form a wide-spread basis to support the upward growth of the stems, and to enable them to expose themselves to the weather, or to connect themselves with other plants, according to their peculiar habits. In all cases, it would be useful so know whether the surface of the soil was likely to afford this mechanical support.

In considering the nature of the soil, with reference to plants, it was necessary to do so partly in respect to its composition, and partly as to its derivation. They had nothing to do, as geologists, with the organic substance contained in the soil, which consisted chiefly of carbon in the state called humus—that belonged to the agricultural chemist, rather than to the geologist; but it was necessary that the latter should know what were the mineral ingredients of which the soil was made up, and how far they were capable of adapting themselves to its organic portions. They had nothing to do with the organic portion of the soil itself, but they had a great deal to do with its relations to the inorganic, or earthy, constituents. The three principal ingredients of all soils were silica, alumina, and lime, which mostly existed in the three conditions of sands, clays, and limestones. There were

also very important mixtures, known as loams and marls—the former being admixtures of clay and sand, and the latter of clay and limestone. With regard to the next point, all soils were derived from the subsoil, and the mode of derivation was a matter to which he drew particular attention. They were derived by the chemical decomposition and mechanical disintegration of rocks; for the soil was connected with and derived from the rock always, either directly or indirectly. [The lecturer here referred to several diagrams, on which were depicted the soils, as they appeared in the course of derivation from the fundamental rock.] In these cases the derivation was direct; but, in others, when the material was brought from a great distance, it was indirect. It was not, for instance, difficult to divine the way in which the weather acted on the surface, or to understand how fragments of rock might be removed great distances, and deposited many miles from their original beds. Every year vast quantities of material were deposited in the Atlantic, brought by icebergs from the Polar regions, and the materials for future soils were thus obtained *indirectly*; what they had most to do with was, however, obtained *directly*, as almost all soils in England, except gravel, were obtained directly. Soils varied in thickness, from a few inches to 100 feet, or 200 feet; but, ordinarily, were from a few inches to 3, 4, or 5 feet in depth. The subsoil also varied a good deal in depth, which depended very much upon local circumstances. The lecturer then referred to the diagram of a road section near Penrhyn. The foundation was slate-rock, and over that was a kind of rubble, into which the rock was decomposed. Rubble was a general term used to describe any rough disintegrated mixture of rock, or broken fragments, with sand; and from the rubble was derived the subsoil, and from that the soil on the surface. In another section, of which a diagram was exhibited, the slate at its usual depth lay in the ordinary direction; but, near the surface, it was "bent over." On this the lecturer remarked, that it was impossible ever to determine the true dip of beds close to the surface, as it was a common thing to find it altered at the surface—broken, in fact, as if by some mechanical force, and often inclined at a considerable angle to the underlying bed. This often helped in the formation of soils; for the broken portions became mixed with sand and silt, and formed rubble, from whence the soil was directly derived. In the diagram alluded to, the next bed to the rubble was a loamy clay, which contained about 50 per cent. of sand. This, however, was not silica, and though it put on the shape of clay, neither was it pure alumina; but a silicate of alumina, mixed with sand. Clay generally contained a good quantity of free sand, and when mixed with about 50 per cent. of that substance, became loamy clay. In that state it was better fitted for agricultural purposes, though it still required more carbonised matter to make it into soil. In the diagram, there was about 2 feet of this loamy clay, which was called the subsoil, and above that the true soil, which, in this case, was of a loamy nature, and contained a rather large quantity of sand. Here, then, was the soil and subsoil directly derived from the rock. The lecturer also further illustrated this point by other diagrams, in which granite was the base from which the rubble was formed.

Soils varied much in value according to their different depths, and the textures of their materials. When the depth was small they were liable to be carried away, or to be soon exhausted by the growth of vegetables on it; and then those particular ingredients, on which the vegetables subsisted, were required to be replaced, or a further decomposition of soil, at a more rapid rate than ordinary, became necessary. The application of other substances from a distance was thus sometimes necessary; but, for this, some chemical, as well as geological, knowledge was indispensable, or more harm than good might be done. The texture of soils differed very much. Some were exceedingly dense and heavy, and would not be easily washed away or displaced; but, though permanent, they were often very difficult to be managed, particularly when they were so dense as scarcely to allow the roots of plants to penetrate. Others, again, were so imperfectly made up, and so large and coarse, as almost to preclude the use of the ordinary instruments of tillage. Some soils contained a great deal of clay, and were so tenacious, as scarcely to allow the plough, or even the spade, to act upon them. These were exceedingly unmanageable, for though it might be thought that a large admixture of sand would lessen this adhesiveness, it was generally found that the sand, after a time, formed hard masses, and was apt to collect the clay into lumps, instead of making it more loose. Some soils possessed a large absorbent power; while others would allow water to pass through them very readily. In soils of the latter kind valuable manures were soon washed through them, without producing much effect. In these cases, a remedy might be found in the practical application of geological knowledge, as, for instance, liming the land, by putting on unburnt limestone in small lumps, instead of slacked lime, and trusting to the slow decomposition of the limestone by exposure to the weather. There were many other circumstances of a similar nature, such as the capillary powers of the soil, or its aptitude to crack and form great yawning chasms in times of drought; the relations of the soil with regard to heat, as its soon becoming hot like sand, or remaining cool, or transmitting heat slowly, like clay. These points depended almost as much on the substance that was below it, as on the texture of the soil itself.

The lecturer then proceeded to describe the soils derived from the various geological formations in different parts of England. The districts, which exhibited chiefly the igneous rocks, were the western parts of Cornwall, some portions of Wales, and the greater part of Scotland, in all of which existed some geological conditions, to be considered in reference to agriculture. In composition these rocks were chiefly granitic, or, as it was called, porphyritic; and they were made up of the crystal imbedded in a kind of paste, and generally of crystals of felspar and mica, in a base of quartz. These rocks existed in very different conditions, dependant principally upon the prevalence of the different ingredients, and their different decomposability. First, they had the quartz, often in compact masses, and so hard, that it was exceedingly difficult to break. Where this mineral was in large masses, and not much modified, it presented a most unfavourable condition for agriculture, and indeed was almost hopeless, as it was next to impossible to get it disintegrated by any natural exposure. When mixed with felspar, however, the case was different, for that mineral contained substances of the greatest importance in the composition of plants. When the felspar in granite decomposed readily on exposure, it often formed a very valuable soil. Much of the best soil in Cornwall was in this condition, particularly that on the lower hills, which, being most exposed to the operation of the weather, contained the greatest quantity of granite in a decomposed state. They would always find that the most fertile granite contained a good deal of decomposing felspar. On the condition of the mica also might depend much of the disintegrability of the granite.

The next rock, he would consider, was gneiss, which contained the materials of granite in a mechanical condition. These would also form a fertile soil; but they might safely conclude, if it were hard and compact, that a good soil would not be likely to be formed. In the Highlands of Scotland there was a vast quantity of gneiss and mica slate, and there the country was uniformly barren on the hills, though there were spots which had been made productive. The whole district, however, might be described as barren, affording support to little vegetable produce besides heather.

Another class of igneous rocks were those which were forced up from beneath others, and were called intrusive rocks. Of this kind were the basalts in Ireland, and the enormous masses of India, where there were 200,000 square miles covered with scarcely anything else. These rocks were nothing more than lava, or melted rock, poured out upon the surface; they were readily decomposable, and among the most useful and important ingredients of soil they were not the least valuable. From these rocks were obtained rich and fertile soils, as was exemplified by the districts in which Indian cotton was grown. These rocks, which in England were often called trap-pean, and which were probably poured out millions of years ago, were capable of being mixed with the soil in their neighbourhood. They contained many of the materials most required by vegetables. Clay-slate was what was called a metamorphic rock, and was, when in its simple and most characteristic form, too little mixed with sand, and contained too few of the materials required by plants to be a valuable substance for soils. It contained, however, a little iron, and sometimes a little soda, and other like ingredients, but not in such a state as would readily mix with carbon, and the gaseous products necessary for plants.

Besides these, there were the oldest rocks, or Silurian rocks, which were formed in Wales, twisted and contorted in every possible way. The lower portions of these rocks were eminently siliceous, with a very small quantity of alumina, carbon, and limestone, and a little potash and soda. Other parts of the Silurian rocks had a great admixture of shales, with nodules of limestone and large lenticular masses, distinctly traceable to local causes. These rocks could be made fertile by careful admixtures.

The Silurian rocks were succeeded by two other formations. The first of these was the old red sandstone, which was found in Scotland, and in corresponding beds in Herefordshire. This, when unmixed, was a very barren rock, and oftentimes formed hills perfectly naked. Assisted, however, with the calcareous lumps called corn stones, it formed sometimes a rich corn land. It was also well adapted for the growth of fruit trees; and produced the apples and pears from which the famous cider and perry of Herefordshire was made. Devonshire, which was also noted for cider, possessed the same kind of soil, though of a different geological period.

The Devonian rocks, containing a large quantity of silicious matter and schists, which prevailed in Cornwall and the north-eastern parts of Devonshire, were also capable of being mixed with other substances, and rendered fertile. These corresponded in age with the old red sandstone, but differed in mechanical condition.

Next to these succeeded the carboniferous rocks, of which there were three distinct divisions. First, the carboniferous limestone, generally compact in form, very hard, very little weather-worn, not easily disintegrated, and not easily decomposed if not disintegrated, covered mostly with a very thin soil, and well adapted for the purpose of sheep, and other animals, which preferred a close fine grass. Rich soils were seldom obtained by admixture with rocks of this kind. Next, there was the millstone grit, not so coarse a conglomerate as the old red sandstone, and commonly better adapted by mechanical condition for agricultural purposes; but not often forming a rich soil, though covering a wide extent of country. And, lastly, there were the coal measures, of which the vegetable produce beneath the surface was of far greater importance than the agricultural excellence of the soil. The third class of carboniferous rocks were met with in the northern and central counties, and in South Wales.

The next in succession were the permian rocks, consisting of the magnesian limestone, which generally coasted the coal measures. This substance could never be safely used as a lime manure—caustic magnesia being always mischievous. The soil derived from these rocks was not remarkable for its richness.

Then came the new red sandstone, which was necessarily a poor soil, consisting of unmixed loose sand, but which was often associated with a con-

siderable quantity of red marl, containing a large proportion of calcareous and argillaceous matter, and this, when brought to the surface, made a most excellent soil. The rich grazing lands of Devonshire and Cheshire, and other parts of England, were constituted of this kind of soil. It was also manageable from its ready drainage, and valuable from the salt obtained from it.

The next substance was lias, and then the whole series of oolites. Lias consisted of thick beds of argillaceous matter, which was more extensively seen in plains and valleys. It formed a very valuable soil, and might be traced throughout England. Lias contained a good deal of calcareous matter, and was not far removed from the new red sandstone on the one side, and the lower sands of the oolites on the other. The oolites were a large class, which supplied in their lower portions a great quantity of building stone, quarried in the neighbourhood of Bath, near Oxford, at Ketton, in Northamptonshire, and elsewhere. These rocks were often overlaid by beds of clay of considerable thickness, as in the fens of Lincolnshire and Cambridgeshire; and in their upper portion the oolites again contained a quantity of hard and valuable building stones, as in Portland Island.

Lastly, there were the cretaceous rocks, which included the dark red sands of Bedfordshire, and the broad and extensive downs of Sussex and Wiltshire, and extended through England to Yorkshire.

Geological Science applied to the Mixture of Soils, and to Draining for Agricultural Purposes.

Professor ANSTED prefaced his remarks, upon the above-mentioned highly interesting topics, by some observations upon the formation of soils from certain rocks, which, in his previous lecture, he had but just glanced at; and, first, as to the cretaceous, or chalk formation, which extended from the western coast of England, commencing near Portland Island, in Dorsetshire, and running in a north-east direction, through Buckinghamshire and Bedfordshire, to the east and south-eastern shores. The chalk formation was divided into two kinds; the most important of which, in some respects, was that known as the lower green sand series. This sand, in Bedfordshire, and some other places, was of a very dark red colour, which, by itself, was liable to be very barren; but, when mixed with clay, it made a very rich soil, particularly if the clay contained a proportion of limestone. The lower green sand was generally underlaid by the Kimmeridge clay, covered up with the gault, which, in Cambridgeshire and elsewhere, formed a stiff clay. In either case, the materials would bear mixing with the green sand, and generally produced rich and productive soils—this formation was, therefore valuable. The upper cretaceous beds contained carbonate of lime in too pure a state to furnish of itself a good agricultural soil. In this way, the chalk could not be considered as affording of itself a rich soil; but rather one which was capable of being made so. It was, however, valuable as a grazing soil for sheep, producing a short fine grass; but the quantity of surface required for the support of a small number of animals diminished its value in this respect very considerably.

He next referred to the tertiary beds, which, in England, embraced only a comparatively small series. The London clay formed the great mass of the tertiary deposits: it was found principally in the neighbourhood of the Thames, and in Hampshire. The London clay was generally underlaid by a more plastic clay, and covered with sand. This was particularly the case at Bagshot Heath, in a large tract of country near Woking, traversed by the South Eastern Railway; and those who had travelled upon that line would have remarked that it passed for the most part through a poor and somewhat sterile country; though, where the clay was mixed with pebbles and sand, it was capable of becoming looser in its texture, and of being made a more available soil, and, indeed, a valuable one, by means of a great deal of manure. The tertiary beds, however, could not be considered naturally valuable for agriculture, although they were often made so from local circumstances. The tertiary deposits of Suffolk and Essex were called crag, and consisted either of a shelly or marly sand, but generally shelly. This was particularly capable of being made a good soil, when mixed with the clays near it.

There were other beds, which, as geologists, they were bound to consider—namely, those which were known by the general name of gravel, which was a mixture of pebbles and sand, and, being liable to accumulate in every favourable locality, was met with everywhere; it was, in fact, the most abundant of the earth's superficial coatings. The circumstances which induced it were exceedingly various, though mostly connected with the changes effected by running water. Where it had accumulated suddenly, the finest sand would be found mixed with the coarsest pebbles; in other cases, it might contain a great deal of clay; and in others, silt. These formed masses, which required always to be considered in regard to their local relations. Gravel constituted not a bad soil for agriculture, as it was readily drained; but it depended on what was near it, or with it, whether it could be made a good one.

All the circumstances connected with the formation and nature of soils geologically must be taken into account when the agriculturalist studied that most important subject, the improvement of the soil by admixtures of other soils. This was a question which required the most careful handling, as it was a dangerous thing to play with soils, and equally hazardous to make speculative changes without a good chemical knowledge. To mix soils with advantage, it was indispensable to have a certain amount of that knowledge, and also an intimate acquaintance with many facts which were purely geological.

In the first place, it was important, if the soil at the surface was not good, and it was sought to be improved by a mixture, to consider its geological relations, the circumstances under which it was presented, and the way in which it was associated with the surrounding material. The appearance of the surface, the structure of the country, the way the beds succeeded each other, and their inclination, ought to be familiar to the geological agriculturalist; and, when it was not so, that knowledge ought to be gained, in the first instance, by sections and models. This knowledge was indispensable; for, without it, they would neither know where to find the material required, nor, when found, be able to get it. Then, again, it was very important to know under what circumstances certain rocks, known to be valuable, might be expected to occur in nature. For instance, there were certain igneous rocks, of volcanic origin, which were very valuable bases for soils, and equally valuable for mixing with others. These had, probably, been produced during a volcanic disturbance, by which they had been forced up in a melted state to the surface, and had, perhaps, not only filled up a crevice, but had also run over in a sheet like lava. Now, it was quite clear that a person ignorant of its geological relations, wishing to obtain this material, would be puzzled by its departure from the ordinary phenomena of strata, and he might waste both time and money, without succeeding at last in reaching the valuable rock. Volcanic rocks of this kind might thus lie either vertically or horizontally; but it must be obvious, that very different operations would be required in each case to obtain them. A difficulty in obtaining them, arising from geological ignorance, was the frequent cause of many valuable veins of igneous rock being neglected, or unknown. The mixture of these volcanic rocks, with others that were stratified, almost always improved the soil; but not invariably, as there were some exceptions to the almost universal rule, of their being easily decomposable by exposure at the surface.

There was one important process in agriculture, often made use of, though not always with similar results—viz.: deep ploughing. By this process, the soil at the surface was mixed with that beneath it, and a large proportion of the subsoil brought to the surface. This was sometimes beneficial, and at others mischievous. Unless the origin of the subsoil was known, it was impossible to determine beforehand whether it would be useful, or otherwise. Generally speaking, it was useful; because the soil was ordinarily derived from the subsoil; and if the soil were good, then the subsoil would be good, and it might be mixed with advantage. This, however, was not always the case; and by deep ploughing, a very different and inferior material might sometimes be turned up. How useful, then, must be that knowledge, by which the certain result of such a treatment of the soil might be previously determined. [The learned professor illustrated this point by a reference to several diagrams, in which the subsoil was represented as derived from various materials.]

The next part of the subject was the soil as connected with water; and there were two cases, in which agriculturally some geological knowledge on this point was important—the one was, when too much water was present in the soil, and it was necessary to get rid of it; and the other was in the way of irrigation, where soils received too little water, or did not retain a sufficiency for the purposes of vegetation. Plants differed enormously as to the quantity of water they required. Soils, which, in this respect, were admirably adapted for one kind, were utterly unfit for another species—some plants grew well on soils where others would not grow at all. In these questions, then, a consideration of the nature of the crop desired, and the climate in which it had to be grown, was indispensable. Draining, also, was connected with geology—both surface drainage and deep drainage; and the methods of obtaining a supply of water, being dependent on the nature of the earth's crust, were equally connected with that science. Drainage involved one or two other points. When it related to the drainage of large districts, it was a subject of the deepest importance, and then it naturally came more under the head of engineering than agriculture. Both draining on a large scale, and the obtaining of water on a large scale, for the supply of our towns and cities, were subjects of the greatest engineering importance; but he intended now rather to consider the general subject with reference to agriculture. In the first place, then, he would touch upon the use of water to plants, which was very simple and easily understood. Plants could not live without it, and they derived it partly from the air and partly from the earth. They also obtained with the water other substances, which were important. None of the plants, which were of value to the agriculturalist, would bear a continual exposure to the presence of water. A great deal of mischief resulted from too much water, although injury was also the result of a want of it. This element came exclusively from the clouds in the shape of rain, or snow. The melting of the snow on the mountains, and tributary rills produced by natural drainage, formed brooks and streams, and ultimately rivers. Springs came out upon the surface, without being apparently connected with the fall of rain, but they were derived from it. The rain was absorbed by certain beds, and often emerged at a great distance, in obedience to certain mechanical laws. [The formation of springs was then illustrated by reference to a number of diagrams; and, by the same means, Professor Ansted showed in what manner irregularities of surface (the permeable beds lying in a favourable direction) produced natural drainage.]

Where there was no natural drainage, the artificial operation connected itself inevitably with the circumstances under which the superfluity of water occurred. One of two things ordinarily would have to be done; they would either have to get rid of the superficial surface-water, and that

which might arise from springs, or they would have to get rid of floods produced by the overflowing of rivers. In either case, the superfluity should be got rid of in a natural way; and, looking at the general character of a district, this would be easy or difficult, according to circumstances. But, whatever the nature of the effect to be produced, a knowledge of the peculiar structure of the district was indispensable; and a practical application of geological knowledge would often help to produce a perfect drainage, by taking advantage of the formation of the earth's crust. Where beds of clay, or other impermeable soils at the surface, rested on beds of sand, the upper beds might be drained by means of perforations, unless it happened that the sand, or gravel below, contained an excess of water, in which case the attempted draining would increase, rather than lessen, the water surface. This condition of the lower beds would, however, be detected by the geologist by a reference to the natural outlet. Another simple and efficacious mode of draining a district, laid under water by springs, was that of cutting a trench along the strata from which the springs arose on their natural outcrop, and thus conveying the water away. The drainage of the surface, however, and cutting off springs, were very different things, and belonged to entirely different conditions of structure.

The subject of drainage on a large scale was one of great importance; and though the drainage of the fen lands was a work generally intrusted to the engineer, rather than to the geologist, yet a knowledge of the principles of drainage was necessary to the agriculturalist, if he wished to take a full advantage of the work of the engineer. The principal works of this kind were in England and Holland. In Lincolnshire and Cambridgeshire, there was a vast tract of land nearly level, composed of a tough clay, quite impermeable to water. It was partially drained by a number of streams which ran across it; but which also drained the higher lands and hills, by which the flat country was hemmed in on the land side. These streams brought down a large body of muddy water, and their tendency was to spread the mud over the low country. When there was a broad expanse of flat land, and a quantity of water thus running over it, the fall being slight, a little thing served to check the passage of the draining streams. In the present instance, the Ouze, the Nene, the Glen, and the Welland, and their tributaries, all ran along the surface of the clay; and if any accumulation of silt were allowed to remain at their mouths, and they could not with facility empty their waters into the ocean, the movement of the stream would be checked. If any foreign body should accidentally fall into the stream, a portion of the bank on the other side of the obstacle would be carried away; and thus, supposing the water ran in a straight line at first, it would, in a short time, deviate from that straightness, and those meanderings which were so admired in other rivers, but which were so fatal in these, would be caused. The more tortuous the course of the stream became, the slower would be its pace, and the less effective its power as a draining agent. At the same time, the gradually increasing accumulation of silt at the mouth would stop the ocean out, and the flush of water from the river would be thrown back upon the land, and thus the low lands would eventually become a swamp. All this, however, might be easily counteracted by keeping clear the streams, and removing the obstructions at their mouths; but, supposing that the natural drains, the rivers, were not sufficient to carry off the whole surplus water, some further operations were necessary, such as artificial cuttings. One of the results of draining being to make the land lower, embankments to keep out the sea were required, and steam-engines, to pump the water from the drains over the embankments into the ocean. The selection of the line of these drains, and the carrying into effect the plans suggested by the circumstances, were operations which had to be performed by the engineers.

Of the fen districts of England, a great deal had already been done towards their drainage—badly at the commencement of the undertaking, but still a great deal also had been well done, and whole districts were now in the course of being drained satisfactorily. The fen district was divided into several sections, known by the names of the streams which intersected them. The principal of these were the Ouze, the Nene, the Glen, and the Welland. The lower part, called the Great Bedford Level, in which the operations had been conducted in the most perfect manner, and at a very enormous expense; the drainage was partly effected by two great cuttings, parallel to each other, from St. Ives to Downham, not far from the place where the Ouze ran into the sea. The tract between the cuttings, which comprised 5,000 acres, was used for the purpose of holding the surplus water, and so preventing it from running over the drained land without the embankments of the two cuttings. In making canals of this kind, the first and principal thing to be done was to construct safely the embankments on either side, the water being lifted over from the ordinary drains by means of steam power. But the case was different when the sea had a tendency to inundate a whole country, and required to be kept out by embankments along a line of coast. This was the case of Holland, of the delta of the Rhine, and of river deltas generally. Deltas consisted of the land formed by deposits of mud at the mouths of rivers. There was often a considerable quantity of organic matter in this mud, secreted by animalculæ, which were killed by the action of the salt water upon them. The difference between the condition of Holland and the fen lands of England was this—in Holland, the soil was being daily added to by deposits of river mud just at or below the level of the sea; while, in England, it was land already formed, and just above the level of low water—so that all they had to do was to keep it so. To maintain their position in Holland, draining operations, of the most gigantic extent, had constantly to be kept going on, at a corresponding magnitude of cost.

The geological conditions necessary to produce fen land were these:—A river coming through a flat country tended to form a delta, which, as it increased in size, became dry, or might be made so by draining. This was one method; but sometimes it happened that a stream ran through flat clay lands near the sea level, when it naturally had no inducement to move otherwise than sluggishly; while, on the least opposition, its banks became washed away, and its waters spread over the adjacent lowlands. It was not, in this case, difficult, by direct cuttings and embankments, and a few steam-engines, to drain the country, and, by certain operations, to clear the mouths of the rivers. On flat coasts a good deal might be, and actually was, reclaimed from the sea by such means. It was proposed at the present time to take in most of the enormous tract of land, now forming the great bay called The Wash, simply by embankments, and, taking advantage of natural advantages, narrowing the outlet of the rivers—enabling the sea to form its own embankment by silt—and pumping out the superfluous water. In Holland, they had to pump out the water from lands below the level of the sea: in this case, the embankment to keep out the sea would alone be necessary, and there would be no great danger from the sea, except at extraordinarily high tides. With regard to books on this subject, there were many Dutch, and some English ones. The last part of the *Agricultural Journal*, vol. viii., containing an account of the present state of the English fens; M. De Beaumont's *Leçons de Geology Pratique*, giving a long account of the deltas of most of the European and other rivers; *Johnstone's Lectures on Agricultural Chemistry and Geology*, and some other works on general drainage, were laid on the table at the close of the lecture by Professor Ansted.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

DECORATIVE ART SOCIETY.

Mr. Dwyer read a paper on the 13th October, before the Society, on the following questions:—What is high art? historical art? fine art? &c. Under what conditions do these become identical? and what is the relative value of each for the purposes of decorative art?

Mr. Dwyer complained of the mysticism and want of definition in all writers treating of what they call high art. For the most part, however, we should find that the study of nature is held to be the starting-point from which we are to be led away into a complexity of technicalities and metaphysical reasonings. As in writings, so it would be found in works. The architect, sculptor, painter, and poet, each attempts a mysterious grappling of mind with matter of fact, occasionally developing a high degree of intellectuality with much that is either unmeaning or not easily understood. Then there is the continually varying misapplication of technical terms in art, arising from an absence of principle in giving fixed names to definite things, which renders it a matter of difficulty to understand the proper limits and distinctions which exist between even such terms as high art, historical art, fine art, &c. He had sought for precise definitions from living artists of good repute and long standing, but obtained none; he had heard much of reasoning, in small circles as it were, which convinced him that a more general and comprehensive knowledge of art in its various phases would be useful, indeed, among its professors. The ordinary criticisms of the day upon art were to him vague and meaningless, and would generally, if divested of doubtful technicalities and expressed in plain English words, expose their flimsy construction. In tracing the progress of art, Mr. Dwyer felt that it had been strangely handled, not alone from the restless ambition of some of its votaries and professors, but still more so by the wanderings of others after the indefinite. Princes and popes have at certain periods patronised its works, but he considered that the attention at present directed towards art, throughout Europe, would probably promote an unprecedented Progress. Nevertheless, he held art in itself to be capable only of slow progress, simply because that must arise solely from a succession of improvements in imitative skill. A parallel to the present demand for variety of style and character had not, he said, existed in any previous period. In painting, sculpture, and architecture, we may learn to discover distinctive features marking a period, and most clearly showing the development of progression. Mr. Dwyer contended that the sameness of treatment in the works of most artists testifies to the tenacity with which copying or imitation clings to all, and that therefore it is essential to reflect and know, how far the different schools of art have relation to each other in respect of imitation,—how much an artist has been indebted to previous examples,—before we can adjudge to him a qualitative rank. Mr. Dwyer then enumerated celebrated works by Greeks, Romans, Italians, Venetians, French, Flemish, and Dutch, which were, he maintained, in harmony with the tastes and moral dispositions of the respective nations at the time they were produced, and also that art is in a great measure localised—dependent on certain rules, as developed by existing specimens, and by the position these held in the public estimation,—that it is essentially a thing of time, place, and circumstance. By judging of works of art upon a particular consideration of beauty, and by admitting one *class* of production as superior in rank to another, without reference to a comprehensive view of art generally, a great injustice has been engrafted on our received opinions upon art. Distinctive ranks in the departments of art, Mr. Dwyer contended, were a

great evil, and to equalise them would be a great good achieved. Until the difficulties attendant upon the operations of art are understood, and unjust prejudices removed—until painters in oil, water, encaustic, and fresco, cease to disparage each other's work, and to exaggerate the importance of their own, until all aristocracy in practice of art shall be dissipated, and art, in humble garb of plaster and clay, be looked upon as kindly as if in marble, until some new energy shall have swept away these prejudices, as unreasonable as unjust, and a combination of artists in one emulative course of comprehensive inquiry and dispassionate reasoning, shall contribute to that one great purpose called art—we must not, it was contended, look for a positive and marked progressive feature to be developed in our times. It was then explained, that art being essentially based upon ideality, with an accurate presentment of effects in form and colour, after nature, is constituted and regulated by certain principles in harmony with the prevailing taste, education, or fashion, so as to excite pleasing emotions; and that it is therefore necessary to specially advance education and train the mind, before the really beautiful in art can be properly appreciated, or the genius evinced receive a just and fair criticism. Several instances were referred to, showing the power of art in expressing clearly and intelligibly to all whatever sentiment it is intended to impart,—as the "Laughing Faun" and the "Dying Gladiator," in sculpture; or the "Creation of Adam," by Michael Angelo; the "Transfiguration," by Raffaelle; and the "Last Supper," by Leonardo da Vinci, in pictures. These examples, it was said, testify to a mental or reasoning ideality, combined with a skill in depicting the essence of things material, and should therefore rank far above imitative skill in the abstract. Ideality is yet more severely tasked in connecting the several ideal embodiments into a grand whole, or complete picture, as in the "Last Judgment," by Michael Angelo. Art such as this, he said, might be called *high art;* but the qualification ought not to be attached to the works of an ordinary artist, whose vanity leads him to lay a surreptitious claim to take rank under such a banner.

The characteristics of Greek art, it was stated, are quite distinct from the examples last mentioned, although both have received great and well deserved admiration. The Greeks, however, approached only to a perfect embodiment of physical beauty, without evolving the attributes of the higher powers of mental reasoning: this would arise simply from their progressive refinements being based chiefly on skilful imitation. Art had undoubtedly been extensively encouraged by the Greeks, from the great number of their works; and if, instead of pursuing the *heroic vein*, they had sought to impart a *moral purpose* (expressions to be taken in their broadest sense), then, indeed, would their productions have attained to a truly glorious eminence. It was Mr. Dwyer's opinion that their wonderful skill, when receiving additional purpose and meaning, would have created much nobler works through their embodiment of mental attributes. The frieze of the Parthenon, he contended, while he had the fullest appreciation of its beauties, ought not to be viewed in any other light than as a production in *imitative art*. Nature, he said, had been so faithfully studied and delineated, that very few inaccuracies could be discovered; but he deduced from this and the pervading similarity of features and vacant expression, not only that the *models* must have been of a superior class, but also that the Greek artists had relied upon their powers of imitating objects as they were seen by them.

The second part of this paper was read by Mr. Dwyer on October 27. His plan of treatment sought rather to embody generally, than to judge of art in its details. Simplicity with purpose constitutes perfection in art; and although these are the most rarely developed, they are most readily recognised by the public. What constitutes historical art? Is it represented by battle scenes, massacres, processions, or reviews? He thought we ought to find a combination of characteristics in persons, time, and place, harmonising with the event represented, and with mental attributes commanding reverential attention, and exciting a feeling of emulation in the spectator. In painting, the accredited substitutes are too commonly portraits and gatherings from old prints. The recent exhibition at Westminster Hall, professedly of historical art, was in point. The painting of "Alfred the Great inciting the Saxons to prevent the Landing of the Danes," displayed a high purpose,—an attempt to show in a simple fact what our navy once was, and lead us to respect him who by his genius [illegible] the bulwarks of our country, and laid the foundation of our pre[illegible]ntile greatness. On the other hand, "The Battle of Meeanee" [illegible] excite a feeling of horror, and was better fitted for the Horse [illegible] than for a decoration in the new palace at Westminster. A moral [illegible]son might be discovered in "Richard Cœur de Lion forgiving Bertrand de Gourdon,"—an embodiment of a noble principle in Christianity. On the other hand, "Edward's *generosity* to the People of Calais during the Siege of 1346," is too problematical. He called attention to a scriptural picture, by Mr. Riviere, relating to the "Seven Acts of Mercy," in which the conditions of sickness, hunger, and the houseless, were expressed through the means of English associations—appealing in English garb to English understandings, and thus rendering art more sympathetic.

The decorations for the new palace at Westminster, according to the comprehensive system laid down by the Commissioners of Fine Arts, afford an unexampled opportunity to artists to gratify the desires of all who venerate painting only in its noblest workings. He hoped the term "decorations" would not continue as hitherto to be misunderstood and restricted in its meaning, by artists generally, and that the time had returned when all branches of the arts would be considered honoured in their application as decorations. What has lately been the general estimation of a painting on a wall? why, mere ornamentation, whereas, if removed from such a position and framed as a picture, it is recognised as of fine art, [illegible] high art. He further remarked that artistic works in metal, such a[illegible] jewellery, &c., would, if in marble, take rank as fine art. These false [illegible]o-distinctions, he contended, had led to an overflow of followers into certain [illegible] divisions of art called professional, while in others, deemed industrial, a [illegible] scarcity equally evident prevails. A skilful designer for manufacturers is as much an artist as the painter of landscapes or portraits, and the designer requires for his purpose abilities both mentally and manipulatively superior to the other. He pointed out Holbein, who, as a portrait painter, imitated admirably, but as a designer, he invented nobly. He also named Quentin Matsys. Successful works in art emanate only from a congenial source, and the taste of a nation must always influence their production. Whatever is truly great or practically useful is always based upon simplicity. The simple outlines of Greek and Etruscan vases, have caused, perhaps, more abstruse geometrical investigations into conic sections than even the planetary systems; yet, he thought, geometry had not been brought to assist art in their formation.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Nov. 1.—Samuel Angell, Esq., V.P., in the Chair.

The Chairman addressed the meeting on the occasion of the opening of the new Session, and alluded to the generally improved character and style of many new buildings in progress, and to the sanitary measures that now so properly engage much of the public attention. He adverted to the loss the Institute had sustained by the death of Mr. George Allen, Fellow, and likewise to the recent death of Mr. L. N. Cottingham, an architect whose talents had justly brought him into considerable notice.

A paper was read by Matthew Digby Wyatt, Esq., on "*Mosaics as applied to Architectural Decoration*," which he illustrated by a large collection of prints, and his original drawings and sketches of mosaics in various Italian churches, some rare Roman and Florentine mosaics, and a variety of specimens of those of modern manufacture by Messrs. Minton and Co., Mr. Alfred Singer, and Mr. Jeakes.

Nov. 15.—Charles Fowler, Esq., Vice-President, in the Chair.

Mons. Firmin Epellet, and Major-General Howard Vyse, M.P., were elected honorary and corresponding members. Mons. Epellet is the architect of the department of the Pas de Calais, and he has recently completed the town-hall of St. Omer.

Mr. T. L. Donaldson remarked on Mr. Knowles's plan of the Parthenon, which was among the drawings exhibited, that it showed a joint in the pavement under the centre of each column of the *naos*, which is quite contrary to modern practice. Mr. Donaldson always considered that there must have been some communication between the *naos* and the *opisthodomos*, for the latter was used as the treasury, and it was necessary that the priests should have access without having to go round to the outside and other end of the building.

Mr. Penrose did not think that this hypothesis could be established, for there were no signs of such a doorway in the remains of the Parthenon.

Mr. C. H. Smith gave an account of a kind of trap or porphyritic building stone used in Devonshire, where Crediton church was built of it. He presented specimens to the Institute. It belongs, he said, to the igneous formations, and is formed chiefly of melted felspar, but having many bubbles, afterwards filled up with carbonate of lime. Its colour and durability vary very much. That of a light grey colour is least to be depended upon. The line of bed could not, he observed, be detected, so as to afford any inference as to its indication of the durability of the stone. He took the opportunity of remarking that with respect to limestones, such as Bath stone, the oolites, Caen stone, &c., setting them in the line of their beds made no difference; it was only in the case of sandstones that any benefit was gained. It is quite impossible for any person to say from an inspection of a block of Caen stone, what is the way of its bed. The best looking stone is the least durable, and the darker the most durable; and generally speaking, the finer grained oolites are the least durable, and the coarser grained the most durable.

Mr. George Godwin called the attention of the meeting to some experiments on Caen stone at Mr. Cubitt's. Without reference to the action of the weather, a piece of Caen stone of the size of a brick, laid with the bed parallel to the pressing surfaces, required a crushing force of 50 tons; another piece laid with the bed perpendicular to the pressing surfaces was crushed by a force of 30 tons only.

Mr. Ambrose Poynter thought it well worthy of notice that the mullions in the windows of Henry the Seventh's Chapel stood, throughout, contrary to the way of the bed, and yet they are in the best state of preservation.

The Vice-President thought this statement of Mr. Poynter's might be reconciled with the experiments detailed by Mr. Godwin, for the mullions had little or no weight to carry, and consequently no crushing force, while they were best preserved from absorbing wet, by having the bed-line of the stone placed vertically instead of horizontally.

In the course of the discussion it was remarked that Caen stone was very variable, containing hidden veins and faults, and nodules of clay, which were liable to be affected by frost.

Mr. Donaldson laid before the Institute an account of the church of Santa Maria del Fiore, at Florence, and of the design for completing the

cinquade, sent to the Institute by Cavaliere Niccolo Matas. The dome is one of the earliest modern domes, and second in size only to St. Peter's, at Rome, but older.

Some discussion took place on the propriety of the meeting coming to an off-hand vote, approving of the design of Cavaliere Matas, and at length a committee was appointed to examine and report.

ON MODEL EXPERIMENTS.

(Continued from page 353.)

In the last number of the *Journal* we obtained formulæ for the comparison of the weights capable of being sustained by similar girders; we now proceed to apply our formulæ to the experiments so ably conducted by Mr. Hodgkinson, with reference to the proposed bridge over the Menai Straits. A report of these experiments will be found in the May number of the *Journal* for 1846, from which we extract the following table and explanation:—

"To obtain the strength of tubes, precisely similar to other tubes fixed on,—but proportionately less than the former in all their dimensions, as length, breadth, depth, and thickness,—in order to enable us to reason as to strength from one size to another, with more certainty than hitherto, as mentioned before. Another object, not far pursued, was to seek for the proper proportion of metal in the top and bottom of the tube. Much more is required in this direction.

In the three series of experiments made, the tubes were *rectangular*, and the dimensions and other values are given below.

Length.			Distance between supports	Weight.	Thickness of Plates.	Last observed Deflection.	Corresponding Weight.	Breaking Weight.	Value of f, for crushing Strain.
ft.	in.	In.	In.	ft. in.	cwt. qr.	Inch.	Inch.	Tons.	Tons.	Tons.
31	6	24	16	30 0	44 3	·525	3·03	56·3	57· 5	19·17
31	6	24	16	30 0	24 1	·272	1·53	20·3	22·75	14·47
31	6	24	16	30 0	10 1	·124	1·20	5·04	5·53	7·74
					lb. oz.			lb.	lb.	
8	2	6	4	7 6	78 13	·132	·66	9,416	9,976	23·17
8	2	6	4	7 6	38 11	·065	·32	2,696	5,156	15·31
8	2	6	4	7 6	..	..	..	..	..	..
4	2½	3	2	3 9	10 12	·061	.435	2,464	2,464	24·56
4	3½	3	2	3 9	4 15	·03	·13	560	672	13·42

The tube placed first in each series, is intended to be proportional in every leading dimension, as distance between supports, breadth, depth, and thickness of metal, and any variations, are allowed for in the computation. Thus the three first tubes of each series are intended to be similar; and in the same manner of the other tubes, &c."

Here it will be observed that in the first set the dimensions are four times the dimensions in the second set nearly, and the dimensions in the second set are very nearly twice those in the first. Comparing the first of the second and third sets, we find in the first of the second set the weight of the tube 78 lb. 13 oz., and the breaking weight 9,976 lb.; and in the first of the third set, the weight of the tube 10 lb. 12 oz., and the breaking weight 2,464 lb. Now, by the formula deduced in our last paper, if w be the imposed breaking weight, w' the weight of a girder in scale 1, the breaking weight of a similar girder in scale u will be $\left(\frac{2w-(u-1)w'}{2}\right)u^2$.

Here $(u-1)=1$; $w'=10$ lb. 12 oz.; $u=2$ lb.; $w=2{,}464$ lb.;

$2w-(u-1)w' = 4918$ lb. nearly $\therefore \frac{2w-(u-1)w'}{2} \times u^2 = 9836$.

This, as will be seen, is only 140 lb. less than the breaking weight as found by experiment. It will be observed, moreover, that the tube in the second set is rather more than twice as thick as that in the first, which sufficiently accounts for the slight discrepancy. Comparing now the first experiment of the first and second sets, we shall find the value of the breaking weight in the first, deduced by the formula from the second—too great:

putting $u=4$ lb., $w'=78$ lb. 13 oz., $w=9{,}976$ lb.,

the breaking weight were = 70 tons,—an excess over experiment of nearly 13 tons. The reason of this difference is obivous: our formula supposes that the breaking tension per square inch, in all the models compared by it, is constant. This, no doubt, would have been the case in the model tubes of Mr. Hodgkinson, had they been constructed of one uniform plate of metal, and not rivetted. The necessity of rivetting is one great cause of the mishaps which are constantly occurring in iron bridges,—as we endeavoured to show a few numbers back, in a paper on the cause of the breakage of the Dee Bridge [see *Journal*, p. 204]: the longer the bridge, the wider and more numerous must be the joints, and the greater the chance of irregular strains. The effect of rivetting, we observe, has been to reduce the breaking tension per square inch one-fifth, in the first of the first set of experiments as compared with the first of the last set;—how much that effect would be increased in a tube 460 feet long, or fifteen times the dimensions of the longest experimented on by Mr. Hodgkinson—we leave our readers to judge.

We trust, in the meanwhile, that Mr. Hodgkinson will continue his labours on tubes of still greater length, by which means only can we hope for anything like an approximation to a law for the mean effect of a number of rivetted joints. However, as we have often observed, the mischief most to be apprehended is not of a statical but dynamical character,—the constant recurrence of vibrations, tending to loosen the joints, perhaps to impair the nature of the iron, and ultimately so to weaken the structure, that a slight jar or strain may be sufficient to produce sudden disrupture of the whole.

CITY OF LONDON UNION WORKHOUSE COMPETITION.

A controversy is going on as to the competition for this building, which is likely to draw the general attention of the profession. The facts, we are informed, are these.

The surveyor who measured the ground for the guardians is named as the favoured candidate, and by a majority of two obtains the award of the first premium. He has resorted to the extraordinary measure of sending round to the guardians a plan and particulars of his own design, and so has brought himself before the tribunal of the public. On this plan he is charged with having taken 17 feet more ground in width than is allowed to the other competitors, the presence or absence of which would make a great difference in the accommodation, as the space of ground is uncommonly narrow.

Had the matter rested merely with the board of guardians, we could not have interfered until a decision had been given; but as the surveyor has pleaded to the jurisdiction of the public, we feel that we have a full right to institute such a comparison between his and the second plan, as will show that there are no sufficient reasons for the selection; and under the peculiar relation of the surveyor and the board of guardians, we cannot but look with suspicion on the present state of the case.

The comparison, unfortunately, is of the defects of the surveyor's plan, from which the other is free. Only eight day rooms are provided for 1,000 inmates,—but then the surveyor says that two "work rooms" are day rooms, and two "dietary rooms" in the *basement* are day rooms, having, consequently, two sunk areas as airing yards. No separation is made of aged women, mothers with children, and prostitutes, who are to be placed in one day room. The rooms for aged couples are made to look out on a dead wall close by, and having privies and urinals beneath. The infirmary does not contain sufficient accommodation. The Poor-Law Commissioners have wisely protested against dormitories on the ground-floor, but the surveyor has provided them. The passages are circuitous, and many of them will require gas in the daytime.

As the strip of ground is long and narrow, the surveyor has made his buildings to stretch across it, so that they can be built against at a future time, and light and air excluded.

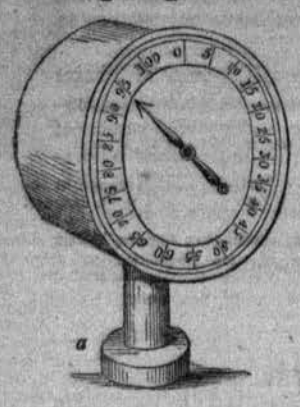
As to the design of the chapel which he has sent round, we cannot but think it too ornate and preposterous as applied in such a building.

The other plan runs in one compact block along the ground in its greatest length, having wide spaces on each side for courts and yards, which can never be interfered with by any buildings on either side. One corridor is carried through the building from end to end, proper access is provided, fourteen day rooms are laid down, no communication can take place between the sexes, and even the male and female infirmaries are separated.

A body of masters of unions have pronounced in favour of the second plan and against that of the surveyor, and it is certain that the latter will be rejected by the Poor-Law Commissioners. Whether the board of guardians, who are friends to the surveyor, will dare to pass his plan after the discussion which has taken place, remains to be seen; but if they do, we shall certainly not fail in our endeavours to do justice to the architectural profession.

SYDNEY SMITH'S PATENT STEAM INDICATOR.

At the third quarterly meeting of the Institution of Mechanical Engineers, held at Birmingham on October 29th., a new steam indicator, patented by Mr. Sydney Smith, was explained to the meeting; it consists of a dial six inches in diameter, and the body four inches deep, and in all, about ten inches high, as shown in the annexed engraving:—



The details of the invention were not given, but from what could be gathered there appears to be a tube of cold water communicating at one end with a steam syphon, attached in the usual manner to the boiler, and the other end of the tube is attached by a flange to the flange *a* of the indicator; at this point there is an elastic web of india rubber, which cuts off the communication of the cold water in the tube; on the top of this elastic web there is a vertical rod, which, as it rises or falls, acts on a weighted pendulum fastened on to the axis of a pinion, gearing into other wheels that communicate with the hands of the indicator. It will thus be seen that as the steam in the boiler increases in pressure, it presses upon the surface of the cold water in the syphon, and consequently the pressure is transferred through the tube of water to the elastic web, and raises the vertical rod, which actuates the gearing of the dial. The only use of the cold water is to keep the india rubber web cool. It does not matter what length the tube may be,—if the indicator be screwed on to one of the legs of the syphon, 18 inches to 2 feet long, it will be sufficient.

The apparatus is out of the reach of the engineer, and the value of the invention is enhanced by the accuracy of the indications not being affected by the distance at which the dial plate may be from the boiler. For example, in marine boilers the indicator may be alongside the compass, and be as faultless a guide of the pressure of the steam, as that instrument is of the course of the vessel.

Mr. George Stephenson considered it a most valuable invention, and stated that he had had one put up at his collieries at Tapton:—"It is placed some distance from the boiler, and in another house, and works most beautifully, showing the rise and fall of the steam in the most delicate manner. The indicator is like the face of a clock, with a pointer, making one revolution in measuring from 1 lb. to 100 lb. upon the square-inch of the pressure of steam; it is quite from under the control of the engineer, or any other person, so that its indications may be relied upon, and the construction is so simple that it is scarcely possible for it to get out of order."

"The Indicator" is adapted alike to high or low-pressure engines. The high-pressure is figured from 1 lb. to 100 lb., and the low-pressure from 1 lb. to 50 lb. upon the square inch.

One of these indicators has been fixed to a boiler at Messrs. Miller and Ravenhill's manufactory, Glass-house-fields, Ratcliff; another in the *Ant* steamer; and one at the Polytechnic Institution.

LIGHT FROM ELECTRICITY.

Mr. Staite delivered a lecture at Newcastle-on-Tyne, on his "*New Mode of Lighting by Electricity.*"

Mr. Staite having first described his galvanic battery and other apparatus, which are on an entirely new principle of his own maturing, and which cannot be well described without diagrams, observed that the production of light from electricity was not a new thing *per se*. The experiment of the charcoal points, and the phenomena of the voltaic arc, with powerful batteries, were well known. The difficulties hitherto experienced had been—1. The economical production and application of the electric currents.—2. The discovery of a suitable material for the development of the light.—3. The rendering of the light permanent (the greatest difficulty of all). By what means, and to what extent, he had overcome these difficulties, Mr. Staite informed his audience. He produced, under a glass receiver, a brilliant light, before which the gas jets of the lecture-room turned, not pale, but yellow. "The peculiar characteristics of the electric light (said Mr. Staite) were its purity and volume. The most delicate shades of colour might be detected, while the eye was not distressed by its effects. The same quantity of light, developed by gas, or any other known means, would be absolutely unendurable. That the light was not the result of combustion, strictly speaking, was evident. There could be no combustion without the presence of oxygen; and, as the light was developed to the best advantage under a closed glass, from which supplies of atmospheric air were excluded, it was quite certain that combustion had nothing to do with the matter." The light, in fact, the lecturer remarked, could be produced as readily in water as out of it He showed its peculiar applicability to coal mining, for it could not explode the foulest atmosphere. He then came to the comparative cost of the electric and other lights. With a battery consisting of four small cells, a light was developed equal to 380 mould candles (sixes), or 300 wax candles, or 64 cubic feet of the best gas, burnt in the standard burner. This was effected by a consumption of zinc equal to 0·77, or 77-100ths of a pound, being little more than ¾ lb. of zinc per hour. When the light, however, was brought to its maximum, by increasing the distance of the electroids to their limit, the light was increased nearly threefold, whilst the current itself was reduced to about three-fifths in quantity. "This curious fact (continued Mr. Staite) I have frequently observed before. So that the light, when developed under the best circumstances consistent with its permanence, was produced by a consumption of a seventh part only of a pound of zinc per hour—and that light equal to 380 tallow candles. Assuming that the zinc so consumed was worth one halfpenny, and that the cost of the working solution, deducting the value of the products (sulphate of zinc, &c.), was as much more, we have the following comparative result:—Electric light, 1d. per hour; gas light, equal thereto, 6d. to 8d.; tallow candles, 7s. 6d.; wax, 12s. 6d." [But, in addition to the zinc and solution, an allowance must be made for apparatus, skill, labour, &c., as in the manufacture of other lights—gas, wax, tallow, &c.] In conclusion, Mr. S. observed, "By a careful comparison of all modes of effecting artificial illumination, I think I am justified in saying that there is no light so cheap as that evolved by voltaic currents of electricity; and there is certainly none which exhibits such pure and brilliant results. The absence of all smoke and flame, and noxious gases—the non-consumption of oxygen—the impossibility of its igniting surrounding substances—and the simplicity of the apparatus—are powerful recommendations for the adoption of the light in all places where purity, and brilliance, and safety, and economy, are sought for."

In the course of his address, Mr. Staite truly observed, in reference to the alleged jealousy of coal-owners, gas-makers, &c., that it was idle to throw obstacles in his way; if his electric light had superior merit on its side, it would come into use in spite of any local opposition; if, on the contrary, in practical value it was inferior to others, it would fall into oblivion.

NOTES OF THE MONTH.

The Building Act.—A committee, nominated by Lord Morpeth, consisting of Mr. Hosking, Mr. Poynter, and Mr. Shaw, the official referees; Mr. Pownall and Mr. Aitcison, district surveyors; and Mr. Biers and Mr. Piper, builders, has been appointed, for the purpose of considering the objectionable parts of the present act, with a view for amendment in the present session of Parliament.

Tidal Harbour Board.—Capt. Betham, R.N., Capt. Washington, R.N., and Capt. Vetch, R.E., have been appointed to form a "Tidal Harbour and Conservancy Board," under the jurisdiction of the Admiralty, each to receive a salary of £800 per annum.—How is it there is not a C.E. in the appointment?

The Nelson Column, Trafalgar Square.—Mr. Carew, the sculptor, has just completed the model of the principal bas-relief, for the compartment of the base facing Whitehall. The group is taken from Southey's "History of the Battle of Trafalgar," were it is stated that Nelson, observing "they had done for him at last," ordered new tiller ropes to be rove as the others were destroyed. There are, in all, fifteen figures, above seven feet high, the centre group taking Lord Nelson to the cockpit.

The School of Design at Somerset House has been re-modelled. The general direction, hitherto vested in the Board of Trade, has been confined to three persons in that office—Mr. Lefevre, Mr. Porter, and Mr. Northcote. The council of all classes of persons has been supplanted by a council of three, consisting of Mr. Richmond, the painter; Sir R. Westmacott, the sculptor; and Mr. Ambrose Poynter, the architect. Mr. Wilson, the late director, has had assigned to him the superintendence of the provincial schools; and two of the late masters, Messrs. Townshend and Horsley, have been appointed professors in the school. There is to be a third professor, but the appointment has not yet been filled up.

Cape Town Gas-Works.—In consequence of an article which appeared in our *Journal* some time since, stating that the apparatus for lighting up Cape Town with gas was then being obtained in England, a correspondent writes us word from the Cape—"It may be gratifying to some of your readers to know that the works have since been erected and in operation now twelvemonths, to the surprise as well as gratification and enlightenment of the inhabitants here, who have most liberally encouraged the undertaking, the works having now nearly 600 lights to supply, with a steady, increasing demand, and which success must be mainly attributed to the ability and persevering energy of the engineer, Mr. Alexander Wilson, formerly of the London Imperial Gas-Works, and to whom the greatest credit is due for the manner in which the works have been carried out and conducted,—but it must not be omitted to mention the able managing director it has lost in the late lamented F. S. Watermeyer, Esq., through whose instrumentality the company was first formed."

College of Surgeons.—The College have bought Alderman Copeland's house in Lincoln's-inn-fields, for £16,000, so as to enable them to enlarge the library and Hunterian museum. This is likely to make more work for Mr. Barry.

Royal Academy.—Mr. Sydney Smirke and Mr. F. R. Pickersgill have been elected Associates.

Highton's Electric Telegraph.—The electric telegraph on the Baden Railway, opened on the 15th of October last, is worked by Highton's Patent Gold Leaf Telegraph, the practical working of which gives the highest satisfaction. Professor Eisenlohr, of Carlsruhe, appointed by the government to superintend it, states that, *with one wire only*, information is being transmitted at the rate of 30 letters a minute; whilst the most complicated apparatus, and one that costs ten times as much, and requires a much more powerful current of electricity, gives not more than 60 or 70 letters per minute, and is not so certain in its action.

China Grass Rope.—A rope has been lately manufactured from a new material, called "China Grass," at Manchester, by Mr. Thomas Briggs, of Salford, expressly for the iron-works of the Earl of Fitzwilliam, at Elsegar; it is 600 yards long, and weighs 14 cwt. 3 qrs. and 14 lb. Ropes made from China grass are stated to be much stronger and more durable than those composed of hemp, but are more expensive. Before manufacturing ropes of a large size from this material, Mr. Briggs had some small ones made, which he tested by working in blocks on his own concerns; he found them to work well, also to be very strong, and of great durability. In coal-pits and mines, where ropes of great strength are required, those made from China grass are much sought.

Turkish Honours.—Tribute to British Science from the Sultan Mahmoud.—Mr. Fairbairn, of Manchester, has been presented with a decoration of one of the Turkish orders, in consideration of the valuable services performed by him in his capacity as engineer to several extensive works, undertaken at the desire of the Sultan.

Professor Willis has undertaken the editorship of Mr. Parker's new edition of the "Glossary of Terms in Gothic Architecture." This engagement will ensure the work being brought out with success.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM OCTOBER 22, TO NOVEMBER 25, 1847.

Six Months allowed for Enrolment, unless otherwise expressed.

William Kirrage, of Warner-place, Hackney-road, Middlesex, for "an Improved combination of material for building purposes, and a new application of certain materials for building purposes."—Sealed October 22. Two months.

Edward Barker, of Budleigh Salterton, Devon, gentleman, for "certain Improvements in the preparation of manure."—October 26.

William Thomas, of Cheapside, merchant, for "certain Improvements in the construction of stays, and in machinery for manufacturing stays; parts of which machinery are applicable to other species of weaving."—October 26.

George Petrie, of 14, Mountford-street, Whitechapel, Middlesex, for "certain Improvements in electric telegraphic apparatus."—October 26.

Charles Carey, of Churchyard-row, Newington Butts, Surrey, gentleman, for "Improvements in obtaining infusions or extracts from coffee and other matters."—October 26.

Meyer Meyer, of Artillery-place, Finsbury, Middlesex, for "certain Improvements in the manufacture of umbrellas and parasols."—November 2.

James Walker, of Glasgow, gentleman, for "Improvements in weaving."—Nov. 2.

Thomas Dunn, of the Windsor-bridge Iron Works, Manchester, for "Improvements in the manufacture of railway-wheels and axles, and in machinery and apparatus for placing carriages on to a line of rails, for removing them from one line of rails to another, and for turning them."—Nov. 2.

William Boulnois, of Baker-street, Portman-square, Middlesex, gentleman, for "Improvements in draught harness."—Nov. 2.

Jean Charles Victor Coulon, of Auxerre, France, for "Improvements in propelling vessels."—Nov. 2.

Bernard Von Rathen, of Putney, Surrey, civil engineer, for "Improvements in obtaining and applying motive power."—Nov. 2.

William Longmaid, of London, gentleman, for "Improvements in the manufacture of alkali and chlorine."—Nov. 2.

Thomas Langton, of Bullwell, near Nottingham, for "Improvements in the manufacture of knitted fabrics."—Nov. 2.

James Murdock, of Staple Inn, Middlesex, for "an Improved capsule or small case for protecting matters enclosed therein from the action of the air, and an improved material to be used in the manufacture of the said capsules."—Nov. 2.

Thomas Hancock, of Stoke Newington, Middlesex, for "Improvements in fabrics elasticated by gutta percha or any of the varieties of caoutchouc."—Nov. 2.

Richard Laming, of Clichy la Garenne, France, for "certain Improvements in manufacturing and purifying coal gas, and in treating a residual product of such manufacture, also improvements in preparing materials to be used in the purification of coal gas."—Nov. 4.

Charles Low, of Roseberry-place, Dalston, Middlesex, gentleman, for "Improvements in the manufacture of zinc, copper, tin, and other metals."—Nov. 4.

Cyprien Marie Jessie Du Molny, of Paris, gentleman, for "Improvements in inlaying and coating metals with various substances."—Nov. 4.

John Lawson, of Paisley, North Britain, for "Improvements in machinery for separating burs, seeds, and other matters, from wool, cotton, and other fibrous substances."—Nov. 4.

George Wells, of 7, Penton-place, Walworth, for "a machine for the purpose of causing communication between the guards and engine-drivers of railway carriages, whilst travelling on railways, and also for communication between vessels at sea and the shore, and for other similar purposes; and which invention it is intended to call an atmospheric signal by land or water."—Nov. 4.

Jean Marie Durafour, of Lyons, France, for "a new fastening or improved system of lacing without eyelet holes."—Nov. 4.

Joshua Procter Westhead, of Manchester, for "Improvements in the manufacture or treating of india-rubber."—Nov. 4.

James Pedder, of New Union Street, Middlesex, for "certain Improvements in steam-engines, and in propelling."—Nov. 6.

Robert Davison, of Broad-street, City, and William Symington, of the same place, for "certain Improvements in the application of heat to the preparation, desiccation, and preservation of bread-stuffs, confectionary, pulse, meats, vegetables, and other edible substances."—Nov. 6.

George Henry Bursill, of Hornsey-road, Middlesex, and Joseph Radford, of Malda Hill, gentleman, for "Improvements in envelopes, wrappers, and covers, and in machinery and apparatus for the manufacture thereof."—Nov. 6.

John Robertson, of Tweed-mouth, Berwick, gentleman, for "Improvements in architecture; the elementary method of formation employed in the same; also further applicable for harmonizing formation, as of urns or vases."—Nov. 9.

Henry Fielder, of Carlton-villas, Malda Vale, Middlesex, for "Improvements in the construction of iron beams or girders."—Nov 9.

Reuben Dyer, of Boston, Lincoln, brewer, for "Improvements applicable to two and four wheel carriages."—Nov. 9.

Edward Waud, of Bradford, Yorkshire, spinner, for "certain Improvements in the construction of machinery for preparing and spinning alpaca, mohair, wool, flax, and other fibrous materials."—Nov. 9.

George Heaton, of Birmingham, for "Improvements in locomotive engines."—Nov. 9.

Henry Krebs Claypole, of Liverpool, gentleman, for "certain Improvements in the process, apparatus, and machinery for making sugar." (A communication.)—Nov. 9.

Joseph Jean Baranowski, of 3, Rue Neuve Clichy, Paris, gentleman, for a ready-reckoning machine."—Nov. 11.

Israel Kinsman, of Ludgate-hill, in the City of London, merchant, for "Improvements in the construction of rotary engines to be worked by steam, air, or other elastic fluids." (A communication.)—Nov. 11.

Frederick Collier Bakewell, of Hampstead, Middlesex, gentleman, for "certain Improvements in machinery or apparatus for making or manufacturing soda water, and other aerated waters, and liquids."—Nov. 11.

Samuel Salmon, of Houndsditch, for "Improvements in rendering certain materials applicable as a substitute for leather, paper, papier mache, and oil cloth, in various articles of manufacture." (A communication.)—Nov. 11.

George James Soward, of Huntley-street, Bedford-square, Middlesex, builder, for "Improvements in suspending window-sashes, shutters, and blinds, and in the construction of the frames for the same."—Nov. 11.

Charles Blackford Mansfield, of Clare-hall, in the University of Cambridge, esq., for "an Improvement in the manufacture and purification of spirituous substances, and oils applicable to the purposes of artificial light, and various useful arts; and in the application thereof to such purposes, and in the construction of lamps and burners applicable to the combustion of such substances."—Nov. 11.

George Taylor, of 2, Bartholomew-place, Kentish-town, gentleman, for "certain Improvements in machinery or apparatus for sweeping and cleansing chimneys, funnels, flues, drains, and other places."—Nov. 13.

James Chesterman, of Sheffield, machinist, for "certain Improvements in tape measures, and in cases used for containing the same; and in the machinery or apparatus for manufacturing or making such measures and cases, or certain parts thereof."—Nov. 13.

George Price Simcox, of Kidderminster, for "Improvements in the manufacture of carpets, and other similar articles."—Nov. 16.

William Edward Newton, of Chancery-lane, for "Improvements in the mode or modes of manufacturing or preparing certain matters to be employed as pigments." (A communication.)—Nov. 16.

George Phillips, of Park-street, Islington, chemist, for "certain Improvements in the purification of certain oils and spirits."—Nov. 16.

William Birkmyre, of Southdown, Cornwall, for "Improvements in smelting copper and other ores."—Nov. 16.

William Brunton, jun., civil engineer, of Poole, Cornwall, for "certain apparatus for dressing ores or minerals."—Nov. 16.

Piere Armand Le Comte de Fontainemoreau, of 15, New Broad-street, city, for "Improvements in manufacturing braids, plats, fringes, gimps, and other similar articles."—Nov, 18.

Piere Armand Le Comte de Fontainmoreau, of 4, South-street, Finsbury, for "certain Improvements in the process and machinery for making, uniting, and preserving metallic and other tubes or pipes." (A communication.)—Nov. 18.

William Rocke, of Dudley, Worcestershire, for "a new mode of heating and applying wrought-iron."—Nov. 18.

Alexander Parkes, of Birmingham, for "Improvements in the manufacture of metals, and in coating iron and steel."—Nov. 18.

Thomas Martin, jun., of New-cross, Deptford, machine maker, for "Improvements in the manufacture of drain tiles, and tubes, and other articles from plastic materials."—Nov. 18.

Thomas Walker, of Hanley, Staffordshire, for "a new and valuable mode of decorating articles of earthenware and china."—Nov. 20.

William Reid, of University-street, Middlesex, for "certain Improvements in communicating intelligence by electricity, and in the instruments and apparatus employed therein."—Nov. 23.

George Philbrick Swinbourne, of Pimlico, Middlesex, gentleman, for "certain Improvements in the manufacture of gelatinous substances, and in the apparatus to be used therein."—Nov. 24.

Richard Coad, of Kennington, Surrey, chemist, for "Improvements in the combustion of fuel, and in applying the heat so obtained."—Nov. 25.

Edwin Travers, of Oldham, Lancashire, cotton-spinner, for "certain Improvements in looms for weaving."—Nov. 25.

William Hutchinson, of Wakeling-terrace, Barnsbury-park, Middlesex, gentleman, for "Improvements in treating pasteboard and other substances, rendering them compact, and impervious to wet, frost, vermin, and other destructive agents."—Nov. 25.

George Holgate, of Spring-hill, near Burnley, Lancashire, cotton-spinner, for "certain Improvements in power looms."—Nov. 25.

Pierre Philippe Celestin Barrat, of Paris, in the kingdom of France, for "Improvements in machinery for tilling and working land."—Nov. 25.

END OF VOLUME X.